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16. ABSTRACT

This periodical is published to inform air pollution personnel of the Environmental Protection Agency (EPA), and others, of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Translations are cited with their sources whenever possible. The subject fields are as follow: Emission Sources; Control Methods; Measurement Methods; Air Quality Measurements; Atmospheric Interactions; Basic Science and Technology; Effects-Human Health; Effects-Plants and Livestock; Effects-Materials; Economic Aspects; Standards and Criteria; Legal and Administrative; Social Aspects; and General and Miscellaneous. All abstracts are listed under one of the above subject fields. A subject and author index are included. This issue contains abstracts 4549 - 4917.

Other individual documents are also available : –

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The purpose of this bulletin is to inform NAPCA personnel and others of technical literature recently accessioned by APTIC. For each accession, the NAPCA Abstract Bulletin number (NAB), the APTIC number, a bibliographic citation, and an abstract are given.

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U. S. Department of Health, Education, and Welfare
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EMISSION SOURCES

4549 APTIC NUMBER 14191

Bellendorf, F.
OPERATING EXPERIENCE WITH A DOUBLE ROTARY DRUM FOR INCINERATION OF INDUSTRIAL SOLID WASTE AT THE CHEMICAL WORKS HUELS AG. (Betriebserfahrungen mit einer Doppeldrehtrommel zur Verbrennung von Industriemuell bei der Chemische Werke Huels AG). Text in German. Brennstoff-Waerme-Kraft, 20(9):414-419, Sept. 1968. ' ref.

Since Aug. 1966, a waste incineration installation with a double rotary drum followed by a waste-heat boiler has been in operation. Its design and pilot tests are discussed. Some shortcomings of the installation and their elimination are reported, and operating experiences are related. The problem of costs of incineration of industrial solid waste is briefly discussed.

4550 APTIC NUMBER 14085

Davis, H. P., O. A. Uyehara, and P. S. Myers
THE EFFECTS OF KNOCK ON THE HYDROCARBON EMISSIONS OF A SPARK-IGNITION ENGINE. Preprint, Society of Automotive Engineers, Inc., New York, 9p., 1969. 12 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690085.)

To determine the effects of knock in a spark ignition, single-cylinder engine with cooled exhaust upon the exhaust composition, exhaust products (CO, CO2, and total hydrocarbons) were measured by non-dispersive infrared analyzers (NDIRA) and by a flame ionization detector (FID). Individual hydrocarbons were separated on a gas-liquid chromatograph. In fuel-rich mixtures, the FID indicated noticeable decreases in the hydrocarbon concentrations in the presence of knock. The NDIRA did not indicate a decrease in the hydrocarbons at knock of lower intensities but showed decreases in hydrocarbons at knock of higher intensities. Chromatograms indicated a preferential decrease in acetylene at the time of knock, causing different responses at lower intensities. In fuel-lean mixtures, no apparent effect of knock on the hydrocarbons was indicated. Thus, it was concluded that in fuel-rich to stoichiometric regions, knock generally decreases the hydrocarbon concentration in the exhaust and the extent of the decreases is greater with the intensity of knock. (Author abstract modified)

4551 APTIC NUMBER 14124

Elmenhorst, H. and W. Dontenvill
CARCINOGENIC HYDROCARBONS IN THE SMOKE FROM CHARCOAL GRILLING. (Nachweis cancerogener Kohlenwasserstoffe im Rauch beim Grillen uber Holzkohlenfeuer). Text in German. Z. Krebsforsch., vol. 70:157-160, Nov. 1967. 9 refs.

The smoke which is formed during the charcoal grilling of bacon was analyzed for its content of polycyclic hydrocarbons. The following polycyclic hydrocarbons were found: fluoranthene, perylene, phenanthrene, pyrene, benzo(a)pyrene, benzo(e)pyrene, chrysene, dibenzanthracene, anthracene, and benzanthracene. The amount of carcinogenic benzo(a)pyrene in the smoke was 129 micrograms/kg of grilled bacon, and it was assumed that the carcinogenic hydrocarbons in the grill smoke were produced by pyrolysis of the fat which dropped on the glowing charcoal. (Author summary modified)

4552 APTIC NUMBER 12650

D. A. Greaves, I. G. Smith
NATURAL GAS CHALLENGES THE GAS INDUSTRY. PART ONE. ORIGINS OF NATURAL GAS. DRILLING. ASSESSMENT OF RESERVES. PROCESSING. Gas World, 168(4393):394-398, Oct. 26, 1968.

Natural gas is a high grade fuel which can be a suitable substitute for other energy sources. The origins of natural gas, methods for locating and recovering natural gas supplies, and purification methods are discussed in this article.##

4553 APTIC NUMBER 14116

Hurn, R. W.
AIR POLLUTION AND THE COMPRESSION-IGNITION ENGINE. Preprint. Combustion Institute, Pittsburgh, 14p., 1968. 9 refs. (Presented at The Combustion Inst. Twelfth International Symposium on Combustion, Poitiers Univ., France, July 14-20, 1968, Paper 61-7.)

The compression-ignition engine, popularly known as the diesel, is examined as a contributor to metropolitan air pollution. Smoke and odor are recognized as the primary targets of public objection to the diesel, and factors relevant to the smoke and odor problem are discussed. Problems of diesel smoke are seen as readily manageable, but a satisfactory solution to the diesel odor problem is not yet available. Other pollutants, e.g., unburned or partially burned hydrocarbons, oxides of nitrogen, and carbon monoxide, are significant products of diesel combustion. Of these, only nitrogen oxides and possibly the aldehydes are typically discharged in quantities that in equivalent volumes may exceed the quantities discharged by spark ignition reciprocating internal combustion engines. Features unique to the diesel combustion process are discussed as factors relevant to generation or avoidance of objectionable pollutants. The high temperatures and oxygen availability in diesel combustion are seen as serious impediments to satisfactory reduction of the yield of nitrogen oxides, but they are favorable in holding concentrations of pollutants in other categories to acceptable low levels. To compound this advantage, the diesel has advantages both in fuel economy and in higher heat value of diesel fuel compared with lighter fuels. Thus, it would appear that diesel power offers an excellent opportunity for continued and expanded application to meet increasingly stringent clean air requirements. (Author abstract modified)

4554 APTIC NUMBER 14168

Ishii, I.
INCINERATOR. 2. PROBLEMS ON DESIGN. (Gomi shokyakuro ni tsuite (2) Sekkei jo no shomondai). Text in Japanese. Netsu Kanri (Heat Engineering) (Tokyo), 20(5):7-12, May 1968. 8 refs.

Design of an incinerator was based on (1) estimation of the character of household trash and garbage, (2) the burning ratio between percentages of household trash and garbage, (3) amount of air in trash, (4) furnace volume, and (5) chimney pressure drop. Trash is expressed at the point of a triangle coordinate whose elements are water, ash, and coal. Burning ratio is derived from elliptical equations whose coordinates are household trash and garbage. The amount of air is assumed to be 0.5 cu mm/kg for household trash and 2.9 cu mm/kg for garbage. Furnace volume is expressed by (burning rate) x (lower heat of generation)/(heat generation in the furnace). Pressure drop is the summation of that of the chimney and of the trash layer. Chimney height is directly proportional to the pressure drop and inversely proportional to gas temperature. Chimney size is determined by Kento's equation.

4555 APTIC NUMBER 12631

K. Karbe
FLUORIDE EMISSION FROM FERTILIZER PRODUCTION. Chem. Eng., No. 221, CE268, Sept. 1968.

Crude phosphates, which are important starting materials for the production of fertilizers, generally contain 3-4% fluorine compounds. In this brief statement to the Working Party on Air Pollution of the European Federation of Chemical Engineering, the emission reactions and the waste gas purification methods are defined.##

4556 APTIC NUMBER 13976

Kayne, James M.
AIR POLLUTION PROBLEMS FROM HIGH TEMPERATURE STACKS. Am. Ind. Hyg. Assoc. Quart., 18(3):246-252, Sept. 1957. 5 refs.

While equipment at reasonable cost and maintenance is readily available for efficient dust collection from normal temperature stack gases, until recently this has not been true for collection problems involving hot and often moist corrosive gases containing appreciable quantities of submicron-size material. Various collection methods are discussed in terms of particle size, concentration, temperature and moisture, corrosion, volume, and effectiveness of compliance with air pollution ordinances. The two basic types of equipment judged best for high-temperature operations are the electrostatic precipitator and wet collector designs. The first gives excellent results on most high-temperature applications and has been used extensively where large gas volumes are involved. However, its high cost makes it especially unsuited for the many smaller volume applications; in these cases, wet-type dust collectors are frequently the best solution. Collection efficiency is high with particles in the low micron size range, and moisture-laden gases can be exhausted without the difficulty of condensation. The major shortcoming is the inability to collect with high efficiency the submicron fumes from metal melting and sublimed salts from similar operations. Data are presented giving the limitations of various dust collectors when applied to high-temperature uses, and showing temperature range, dust loading, particle size, and type of collector normally used for the more common high-temperature applications: chemical and fertilizer operations, coal mining, fly ash, incineration, metal melting, and metal mining and rock products.

4557 APTIC NUMBER 14257

Kurtz, R. and W. G. B. Mandersloot
DISPERSION OF POLLUTANTS IN THE ATMOSPHERE AND RELATED ATMOSPHERIC PHENOMENA. AN ANNOTATED BIBLIOGRAPHY. Council for Scientific and Industrial Research, Pretoria, South Africa, Chemical Engineering Group, CSIR Subject Survey O/Chem 4, Rept. 66/51/4510/2, 97p., May 1969. 519 refs.

An extensive annotated compilation is presented of literature pertaining to the problem of stack height and its relation to the dispersion of pollutants. The bibliography was assembled in recognition of the interdisciplinary aspect of the subject, which is of interest in plant engineering, factory management, air pollution control, and as a problem in fluid dynamics, physics and atmospheric science. It is hoped that the availability of such a bibliography will facilitate the consultation of a much greater part of the literature by members of these professions and disciplines. The theoretical approaches to stack height calculation found in the literature surveyed is briefly discussed, and several other sources of abstracts on this subject are given. Most of the references in the bibliography are followed by a very short summary of the subject covered by the paper.

4558 APTIC NUMBER 14074

Loggewie, G. and I. Skunca
SOOT FORMATION TENDENCY OF LP-GAS IN ATMOSPHERIC BURNERS. (Untersuchungen ueber die Russbildungsneigung von Fluessiggasen in atmosphaerischen Brennern). Text in German. Intern. Z. Gaswaerme, 18(3):122-123, March 1969. 3 refs.

Using the cooker burner of a multi-gas range, the authors determined the tendency to form soot when the range was supplied with hydrocarbon gases under equal pressure. The input of primary air was so adjusted as to cause incipient yellow flame tips to occur. The tendency to form soot increases in the order: propane, butane, propylene, and butylene.

4559 APTIC NUMBER 13963

Morrison, Warren E. and Charles L. Readling
AN ENERGY MODEL FOR THE UNITED STATES, FEATURING ENERGY BALANCES FOR THE YEARS 1947 TO 1965 AND PROJECTIONS AND FORECASTS TO THE

YEARS 1980 AND 2000. Information Circ. 8384, Washington, D. C., Dept. of the Interior, Bureau of Mines, July 1968, 127p. 28 refs.

A simplified energy model for the U. S. is quantified for 1947-1965. The basic model and calculated quantified structures are used for a number of analytical case studies that estimate midterm and long-range shifts in patterns of energy resources demand and required supply. Historical data series are presented in the form of integrated energy balances by source, form, and consuming sector. In case studies I to III, conditional projections of historical trends of energy demand and required supply are made for the midterm period 1966 to 1980. The projections are carried out by correlation of major energy components with relevant independent variables such as major economic indicators. Simulations of the medium-range projections to 1980 are carried out by varying the assumptions for midterm period. Case studies XIII to XXII are long-term contingency or technological forecasts to the year 2000. These cases assume technological changes or innovations that produce major shifts in the long term pattern of energy consumption and the mix of required resources. The domestic resource base is assessed in its ability to meet projected or forecast demand for energy resources under the midterm and long-run assumption made in the various case studies. Various energy issues or problems identified from the analyses of the case studies are discussed, and possible alternative approaches to solutions are suggested. (Author abstract modified)

4560 APTIC NUMBER 14113

Murray, F. E.
AIR POLLUTION FROM BIVALENT SULFUR COMPOUNDS IN THE PULP INDUSTRY. Preprint, Engineering Institute of Canada, March 1968, 16p., 10 refs. (Presented at the Banff Pollution Conference, Banff, Alberta, Can.)

In the kraft process of producing chemical cellulose from wood chips, the chips are cooked in a solution containing sodium hydroxide and sodium sulfide in about a four-to-one proportion. This method produces much greater air pollution, in the form of highly malodorous compounds, than the alternative sulfite processes. The three primary sources of odor production in a kraft pulp mill are the digestion process, the direct-contact evaporator, and the recovery furnace. In the digestion process, control must be effected on the noncondensible gases from the digester and blow tank, from the multiple-effect evaporators, and on the foul condensates that are formed in contact with these gases. The emission of hydrogen sulfide from black liquor during direct contact evaporation can be very substantially reduced by oxidation of the sulfide. The problem of the recovery furnace is one of good operation and combustion control within the furnace design capacity. Present laboratory studies are expected to lead to continuing improvement in the control of odorous emissions from kraft pulping operations.

4561 APTIC NUMBER 13977

Newmark, Franklyn T.

POLLEN AEROBIOLOGY - THE NEED FOR RESEARCH AND COMPILATION. Ann. Allergy, 26(1):358-373, Jan. 1968. 132 refs.

The field of pollen aerobiology is concerned with the mechanisms and effects of the transfer of antigen from the pollen of certain plants to the respiratory mucosa of man. This compilation was prepared as a response to the need for a periodic review of the research literature in this field. Various aspects of pollen as a cause of hay fever and of its distribution are summarized on the basis of an extensive and up-to-date bibliography: pollen chemistry, including antigen analysis and cross-reactivity; the scientific basis of hay fever and its application to clinical factors; botanical and atmospheric considerations in pollen distribution; pollen sampling and surveys; and pollen control efforts. Historical background is given. Sources, subject matter, and future needs of the literature of pollen aerobiology are discussed. It is noted that chemical pollutants in the air seem to enhance the action of pollen in producing respiratory allergic symptoms.

4562 APTIC NUMBER 18033

Pahnke, Alden J. and James F. Conte
EFFECT OF COMBUSTION CHAMBER DEPOSITS AND DRIVING CONDITIONS ON VEHICLE EXHAUST EMISSIONS. Preprint, Society of Automotive Engineers, Inc., New York, N. Y., 28p., 1969. 15 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690017.)

Hydrocarbon exhaust emission levels of new cars driven under consumer-type conditions increase during the initial 5000 to 10,000 miles of operation; the magnitude of the increase is less with vehicles equipped with exhaust control systems. The role of combustion chamber deposits in increasing hydrocarbon exhaust emission levels during the initial period of vehicle operation was considered. Analyses have shown these deposits to contain high concentrations of lead salts originating from the combustion of lead alkyls present in gasoline. Two consumer-type vehicle tests to determine the effect of leaded and unleaded gasoline on exhaust emissions were completed. One test involved 122 cars without exhaust control systems and the other, 36 cars with exhaust control systems. In both tests, hydrocarbon exhaust emissions of the leaded and unleaded cars increased during the initial period of mileage accumulation and then leveled out as equilibrium was reached. Average hydrocarbon emission levels of the leaded cars were higher than those of the unleaded cars with the difference or net lead effect amounting to 7% in both the 122-car and the 36-car tests. No significant differences in carbon monoxide or nitrogen oxide emission levels were observed. Photochemical reactivity levels were essentially the same for the leaded and unleaded car groups in the two tests. A limited study of the effect of mileage accumulation conditions on exhaust emission levels was carried out. Results obtained under rapid or accelerated mileage accumulation conditions did not correlate with consumer test results. (Author abstract modified)

4563 APTIC NUMBER 18286

Pakter, M. K., D. P. Dubrovskaya, A. V. Pershin, and G. K. Talalaev
MERCURY IN CARBONIZATION BY-PRODUCTS. Coke Chem. (USSR) (English transl.), no. 11:41-44, 1968. 7 refs.

The mercury content of various carbonization products from Soviet coke and Chemical works was checked. Mercury was present in the precipitates from tar and tar liquor, predominately in the form of sulfides. The tar contained approximately 40% of the mercuric sulfide. When the tar was rectified, about 40% of the mercury was released in metallic form. Under appropriate cooling conditions, it is liberated in the condensing apparatus. The remainder of the tar mercury contained mainly anthracene, oil, and pitch. Nearly all the mercury was distilled off when hard pitch was produced. It was established that mercury collects in significant quantities only in coal tar, in certain precipitates, and in sulfuric acid tar. (Author conclusions modified)

4564 APTIC NUMBER 14026

Starkman, E. S., H. E. Stewart, and V. A. Zvonow
AN INVESTIGATION INTO THE FORMATION AND MODIFICATION OF EMISSION PRECURSORS. Preprint, Society of Automotive Engineers, Inc., New York, 9p., 1969. 15 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690020.)

A detailed observation of the mechanisms by which undesirable products of combustion are formed and modified during residence in the engine cylinder was attempted. A hydraulically actuated sample valve, different from the electrically or mechanically driven ones involved in previous studies, was utilized. The combustionchamber of a spark ignition engine was sampled directly with a hydraulically actuated and controlled valve. This resulted in increased flexibility in sample size and in the time of acquisition, and thus permitted a much more comprehensive history of combustion gas composition to be obtained. The cold wall was found to influence equally carbon monoxide, carbon dioxide, and nitric oxide formation, as it has been previously shown to influence unburned hydrocarbons. Results indicated that sample fraction should be at least 1% of cylinder content if the chemical analysis is to reflect conditions away from the wall reliably. There was evidence that large gradients in composition are created across the combustion chamber and these gradients persist throughout the expansion. Examination of engine operating variables, such as spark advance, compression ratio, mixture strength, and speed, provided more evidence of the role which chemical kinetics plays in determining the concentration of nitrogen oxides appearing in engine exhaust.

4565 APTIC NUMBER 13988

Starkman, E. S.
BASIC PROCESSES DURING FORMATION OF OXIDES OF NITROGEN AND CARBON MONOXIDE IN INTERNAL COMBUSTION ENGINES. (Grundlegende Vorgaenge bei der Entstehung von Stickstoff- und Kohlenmonoxid in Verbrennungskraftmaschinen). Text in German. ATZ (Automobiltechnische Zeitschrift) (Stuttgart), 71(4):130-134, 1969. 12 refs.

Recently-developed emission and absorption spectroscopic methods for the instantaneous determination of combustion gas composition in operating internal combustion engines enable one to record the variation of the concentrations of NO and CO in the course of an engine cycle. Measurements carried out by these methods show that the commonly used assumption that the actual NO and CO concentrations are close to their theoretical equilibrium values at any given temperature is quite inadequate, as the actual values are invariably much higher than the theoretical values. Similar findings apply to exhaust gas compositions of gas turbines. The author points out that as the fuel-to-air ratio in an internal combustion engine is increased, the NO and CO concentrations in the exhaust gas decrease and increase, respectively. This suggests the theoretical possibility of drastically reducing the concentrations of both by operating the engine with a fuel-to-air ratio for which the NO and CO concentrations in the exhaust gas are numerically equal and by inducing these two constituents to interact according to the equation: 2NO plus 2CO yields N2 plus 2CO2. The practical realization of this idea rests on the possibility of developing engines capable of operating at the required fuel-to-air ratio, carburetors capable of maintaining the required fuel-to-air ratio at the prevalent operating conditions, and catalysts or other means of facilitating and accelerating the above reaction.

4566 APTIC NUMBER 14127

Stone, R. K. and B. H. Eccleston
VEHICLE EMISSIONS VS. FUEL COMPOSITION. Preprint, American Petroleum Institute, Montreal, Can., Div. of Refining, 50p., 1968. 9 refs. (Presented at the Session on Air and Water Conservation, 33rd Midyear Meeting of the American Petroleum Institute Division of Refining, Philadelphia, Pa., May 16, 1968, Preprint No. 43-68.)

Reduction of evaporation losses from motor vehicles was investigated as a means of lessening the amount of pollutants reaching the atmosphere. The effect of fuel volatility and of front-end fuel composition on the quantity, composition, and photochemical reactivity of vehicle emissions including both tailpipe and fuel-system losses were studied. In addition, the test variables included engine fuel-system features and ambient temperature, which was varied over a range of 20-95 F. Results of tests on eight 1966 model cars are given. Driving cycle and instrumentation typical of current practices for emission studies were used. Test results showed that at high ambient temperatures, a large reduction in evaporation losses accompanied a reduction in front-end fuel volatility. However, there was also a small adverse effect on exhaust emissions from volatility reduction. Reactive hydrocarbon emissions from evaporation were reduced substantially by either volatility reduction or saturation of light olefins. Light olefin reduction also reduced exhaust reactivity. Carbon monoxide emissions showed a small increase as fuel volatility was reduced, while nitrogen oxides and aldehydes showed no significant fuel effect. (Author abstract modified)

4567 APTIC NUMBER 14311

Tecquipment Ltd., Nottingham, England
TEST AND RESEARCH ENGINE. Design and Components in Eng., no. 19:30-32, Oct. 14, 1968.

The Varimax, a versatile new test rig and engine developed by Tecquipment Ltd. is described. The engine, which can be run as a diesel or gasoline unit, is actually a comprehensive test installation permitting the rapid and wide variation of such features as compression ratios and valve ignition timing without the need to stop or dismantle the engine. It can be used to study the combustion process and exhaust emissions as well as to investigate performance phenomena. More specifically, it permits the study of differing compression ratios relative to performance and thermal efficiency; various valve timings; fuel injection and ignition variations; engine performance on lean mixtures; the effects of fly-wheel inertia on performance; excessive restrictions in the inlet manifold, undersize chokes; exhaust gas analysis; full and part load performance characteristics and experimental verification of main bearing loads, besides providing the opportunity for students to acquire proficiency in engine tuning and other skills. The heart of the system is the Varimax single-cylinder, twin overhead camshaft engine with a stroke/bore relationship of 3.75 in./4.5 in. and a displacement of 814 cc. The speed is restricted to 2000 rpm at which it develops about 10 bhp in its naturally aspirated form. A diagram and additional technical details of the engine are presented.

CONTROL METHODS

4568 APTIC NUMBER 13987

Abthoff, J. and H. Luther
THE MEASUREMENT OF OXIDE OF NITROGEN EMISSION FROM DIESEL ENGINES AND ITS CONTROL BY MODES OF ENGINE OPERATION. (Die Messung der Stickoxid-Emission von Dieselmotoren und ihre Beeinflussung durch Massnahmen am Motor). Text in German. ATZ (Automobiltechnische Zeitschrift) (Stuttgart), 71(4):124-130, 1969. 14 refs.

Endeavoring to lower the carbon monoxide and nitrogen oxide emissions by diesel engines, the authors carried out an extensive series of measurements on three water-cooled four-cylinder and three air-cooled single-cylinder diesel engines, three of which had direct fuel injection, two were equipped with a mixing chamber, and one worked by the 'M' method. The standard equipment of an internal combustion engine performance-test stand was augmented by apparatus for exhaust gas analysis. During engine operation, samples of exhaust gas were removed through a tap from the exhaust pipe, cooled, dried, and conveyed through a branched pipe to three measuring stations. One part of the sample was analyzed in a flame ionization detector, another was used for determination of the CO and CO2 contents by recording infrared absorption analyzers, and the third part was first oxidized and then admitted to a photometer for determination of its total NO2 content. In the oxidizer, developed by the authors for speedy intermittent oxidation of NO to NO2, successive exhaust gas samples are pumped alternately into one of two oxidation chambers. The exhaust gas is pressurized, oxidized by compressed oxygen, and released through a pressure-reducing valve into the NO2 photometer. In addition, the possibilities of lowering nitrogen oxide emissions were discussed: changing the fuel composition (cetane/alpha-methylnaphthalene mixtures), the use of various ignition accelerators, recycling of the exhaust gas, changing the fuel-injection timing, or introduction of water into the combustion chamber.

4569 APTIC NUMBER 14263

Agarwal, Paul D., Robert J. Mooney, and Richard K. Toepel
STIR-LEC I, A STIRLING ELECTRIC HYBRID CAR. Preprint, Society of Automotive Engineers, Inc., New York, 16p., 1969. 11 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690074.)

An experimental vehicle was designed to explore the use of a low-emission engine and electric drive system in a small car. A small car was modified to use a variable-speed ac electric motor to drive the rear wheels through reduction gears and the differential. Batteries provided electric power to the motor through electronic circuitry and gave the variable frequency required for speed control. A small Stirling engine, driving an alternator supplied energy to the batteries. The Stir-Lec I proved the technical feasibility of a Stirling engine, an electric hybrid power train for a limited performance vehicle for city driving. Such a hybrid combination has the advantage that the heat engine can be of small power rating required to operate the vehicle at steady speeds and peak power demands can be met by the battery-electric drive system. On the other hand, the extra cost and complexity of the hybrid system would make it difficult to compete with simpler propulsion for private passenger vehicles.

4570 APTIC NUMBER 13958

Agnew, W. G.
FUTURE EMISSION-CONTROLLED SPARK-IGNITION ENGINES AND THEIR FUELS. Proc. Am. Petrol. Inst. Sect. III, vol. 49:242-280, 1969. 26 refs.

Future trends in vehicle and gasoline design for the purpose of meeting increasingly stringent air pollution controls are discussed. Federal exhaust emission standards for 1970 are more stringent than those for 1969. Standards now require 10% lower hydrocarbon and CO emissions and measurement methods have been changed from a concentration basis to a calculated mass basis. Emission control systems are improved and are integral with the power plant and the fuel system. Included in future plans are evaporative emission restrictions, nitrogen oxides emission control, and more stringent hydrocarbon and CO emission controls. New devices available for control include large manifold air injection reactors, catalytic converters, and alternate power plants such as gas turbines, external combustion engines, and electric propulsion. Attention will be given to reducing the extreme deviations of high volatility gasolines in the summer and low volatility gasolines in the winter and reducing eye irritation by reducing the amount of aromatic hydrocarbons in the engine exhaust gas. Propane may be used since it permits leaner mixtures. While emission standards are set, companies will try to maintain or improve present levels of driveability, reliability, fuel economy, cost, and owner convenience. At the same time, the oil industry will be making necessary changes to ensure that the new hardware systems will operate with the greatest possible satisfaction to the car owner.

4571 APTIC NUMBER 14269

AVCO Corp., Lowell, Mass., AVCO Applied Technology Div.
EVALUATION OF GRANULAR BED DEVICES. PHASE III. Contract PH-86-67-51, AVATD-0107-69-RR, 90p., June 1969. 19 refs.
FSTI: PB-185561

Recent interest in dry sorption processes for SO2 removal from hot stack gases has led to investigation of the concept of a dry granular bed device used as a simultaneous SO2 sorber-fly ash collector for power station flue gases. In these devices, an SO2 sorber such as alkalized alumina would also act as the granular particles for collecting fly ash. At present, it is not possible to accurately predict dust collection performance on granular beds from aerosol filtration theory. A survey was undertaken to identify the most likely candidates among granular bed devices for power plant services. Most of the devices considered were panel filters, in which granular material filled a narrow vertical shaft. In the crossflow configuration as exemplified by the Dorfan-Impingo Filter or the Carnegie-Mellon shaft filter, the granules steadily fall through the shaft,

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carrying out with them accumulated dust, while the gas flows through the face of the panel in a crossflow manner. In the Squires designs, the granular material is held in the bed during treatment and intermittently removed from the panel by pneumatic or mechanical means. The Squires GSC design by virtue of appropriate internal spacers affords countercurrent gas-solid contacting. Little detailed data is available on the performance of the above sorber-dust collectors. Mathematical models for SO2 sorption on alkalized alumina were developed for counterflow, and fixed bed contactors. Calculations using these models indicated that there was no critical problem with regard to removal of SO2 under conditions which the developer of a particular device considered good for dust collection. Mechanical layouts were developed for the Squires GSC and crossflow designs to enable arrival at preliminary comparative cost estimates. Since, of the non-proprietary designs, neither the Squires nor the crossflow design has been tested to the extent necessary to demonstrate good mechanical operability, it is recommended that experimental work be undertaken on these two concepts. (Author abstract modified)

4572 APTIC NUMBER 14034

Benson, Jack D.
REDUCTION OF NITROGEN OXIDES IN AUTOMOBILE EXHAUST. Preprint, Society of Automotive Engineers, Inc., New York, N. Y., 17p., 1969. 11 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690019.)

One of the reactants involved in photochemical smog is NOx, defined as the sum of nitric oxide (NO) and nitrogen dioxide (NO2) concentrations; NO, emitted by automobiles in exhaust gas, slowly oxidizes to NO2 under atmospheric conditions. Although the control of nitrogen oxides from automobile exhaust is not yet required by law, several methods were investigated to determine how much control is possible and what penalties result. These methods involved spark timing, carburetion, and exhaust recirculation. On one test car, a control system was developed which reduced nitrogen oxides 78% while maintaining hydrocarbon and carbon monoxide control at current (1968) federal levels. However, a 13% loss in fuel economy was incurred, and driveability problems were observed. Application to other car models, deposit accumulation, durability, and performance under extreme weather conditions are all open questions at this time. (Author abstract modified)

4573 APTIC NUMBER 14202

Bjerklie, J. W. and B. Sternlicht
CRITICAL COMPARISON OF LOW-EMISSION OTTO AND RANKINE ENGINE FOR AUTOMOTIVE USE. Preprint, Society of Automotive Engineers Inc., New York, 16p., 1969. 16 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690044.)

Rankine cycle external combustion engines, which are currently used for low emission power plant systems, are considered in terms of their application to automobiles meeting future pollution requirements. A comparative study of theoretical reciprocating and rotary Rankine cycle engines using steam and organic fluids with existing Otto automotive engines indicates that the performance of the former should be superior with respect to size, torque, economy, emission, response, maintenance, and reliability. Use of external combustion, which means that the engine can use the same fuel burned in power plants, will reduce fuel cost and produce inherently lower emissions. With presently available fluids and with the most practical machinery presently known, the steam reciprocator is best able to compete with the Otto cycle engine. However, development of an 'ideal' low temperature, nontoxic, nonflammable fluid should lead to vapor engines significantly better than the reciprocating steam engine. These engines will require no regenerator or superheater and will not have the cost and size disadvantage of the steam system. Reciprocating vapor engines will develop very high torque merely by feeding high pressure vapor to the cylinder. It is hoped that chemical and petrochemical companies will concentrate on the development of the 'ideal' fluid.

4574 APTIC NUMBER 14316

Bloch, Herman S.
WASTE GAS OXIDATION PROCESS USING CATALYSTS COMPRISING VARIABLE DENSITY ACTIVATOR. (Universal Oil Products Co., Inc., Des Plaines, Ill.) U. S. Pat. 3,458,276. 6p., July 29, 1969. 5 refs. (Appl. Dec. 11, 1967, 6 claims).

The invention relates to a novel oxidation catalyst and to its preparation and use. It is directed to making an oxidation catalyst comprising a variable density activator useful for converting exhaust gas streams, such as those emanating from vehicular and stationary internal combustion engines, to less harmful products. The combustibles in a waste gas stream are burned by direct contact of the stream with a mixture of oxygen. This is done at the oxidation temperature with a bed of catalyst particles of a porous high-surface area refractory oxide base or support coupled with one or more oxidizing metals. The minor portion of the surface area is composed of a number of small localized spots of catalytic metal at a high density of 10-20,000 micrograms/sq m. The remaining surface area has a uniform distribution of catalytic metal at a low density of 0.9-10 micrograms/sq m. The total catalytic metal content of each particle is 0.03-10% by weight. The catalyst is prepared by forming small solid plastic particles containing the catalytic metal. The plastic particles are reacted with a hydrosol of the refractory oxide followed by gelling and formation of hydrogel particles which are larger than the plastic particles and which contain at least one plastic particle each. The hydrogel particles are calcined to burn off the plastic. This leaves the refractory oxide particles, the surface of each comprising a localized spot of relatively high activator density.

4575 APTIC NUMBER 14120

Boyer, Robert Q.
THE WESTERN PRECIPITATION RECOVERY SYSTEM. TAPPI, 43(8):688-698,

Aug. 1960. 21 refs.

The Western Precipitation recovery system, which uses the crystallization separation of the sodium sulfide of the smelt, reacts all of the separated sodium sulfide with the spent liquor sulfite sulfur through an oxidation reduction reaction known as the Bradley process. The reacted liquor is evaporated and burned in inexpensive kraft equipment. The cooking liquor is produced by adsorption recovery of the flue-gas sulfur dioxide in a sulfite-bisulfite solution that uses the recovered sodium carbonate as the make-up base. The absorption of the SO2 take place in a recovery tower where sodium carbonate is injected in a 1:1 ratio to the sulfur. The sulfur dioxide recovery tower is capable of a 97% efficiency. Any traces of H2S are removed from the solution in a separate head tank, thus eliminating odor. This system at an experimental recovery plant has completely processed spent liquor from sodium-base acid sulfite, two-stage sulfite, and NSSC cooks separately and in combinations. The scale formation in the evaporators is eliminated with the proper pH control by the amount of recycled sulfide sulfur. This sulfur can be either increased with the addition of sodium sulfate to the firing liquor or reduced with addition of inventory sodium sulfide. A relationship between the rise in pressure and rise in boiling point is used to control the evaporation-crystallization. High sulfur, soda, and heat recoveries are possible. (Author abstract modified)

4576 APTIC NUMBER 14248

Caprioglio, Giovanni
REVIEW OF BATTERY SYSTEMS FOR ELECTRIC VEHICLES. Preprint, Society of Automotive Engineers, Inc., New York, 8p., 1969. 18 refs. (Presented at The International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690129.)

The requirements and characteristics of electric vehicles are analyzed and solutions being considered for power sources are reviewed. The requirements of a vehicle are classified into performance, economy, and convenience factors. Advances in present battery technology provide the conditions for the competitive existence of electric vehicles for special uses. One of several systems being developed in order to overcome the weight limitation of the lead-acid battery is the alkaline metal-oxygen battery based on the same principle as the old air depolarized primary cells. The zinc-air battery is being studied in two versions. One is based on a circulating electrolyte providing for storage of the zinc oxide externally to the cell, and the other utilizes a porous zinc-zinc oxide electrode. Other couples being investigated are iron-air, aluminum-air, and magnesium-air with neutral salt electrolyte. Two high-temperature batteries are the lithium-chlorine and the sodium-sulfur. It was concluded that with the incentive of the alleviation of air pollution, it is reasonable to expect a larger use of electric vehicles, especially in the area of short-range fleet-operated delivery vans. The present technology can already provide attractive characteristics of performance and cost. But in order to enter the much larger market of the passenger car, a major breakthrough is needed in the field of the electric power source. The zinc-air system is attracting the largest interest today, and it is reasonable to believe that a zinc-air battery should be available in the near future.

4577 APTIC NUMBER 14060

Carmassi, H. and J. Helein
OPTIMIZATION OF PROCESSING UNITS FOR PRODUCTION OF SULPHUR FROM HYDROGEN SULFIDE. (L'optimalisation des unites de production de soufre a partir de l'hydrogene sulfure). Text in French. Chim. Ind. (Paris), 100(11):1733-1740, Dec. 1968. 4 refs.

At the sulfur plant of the Societe Nationale des Petroles d'Aquitaine at Lacq, local natural gas is desulfurized by first separating methane and heavy hydrocarbons from CO2 and H2S and then converting the latter into S by the Claus process, carried out in three cascaded subunits. The authors describe at length three schemes of automatic control of the above process designed to maintain, by varying the combustion air-to-acid ratio in subunit 1, the maximum S yield at the lowest possible S content of the residual gas. This optimization method combines a high S yield with a low S emission. The first control method utilizes a simple mathematical model of the process which requires current measurements of temperature and pressure of both air and acid gas, the molar rate of H2S flow, and the molar concentration of H2S and methane in the acid gas, and has the disadvantage that sufficiently precise composition measurements are difficult to obtain. Another control method employing test inputs to the rate of flow of combustion air and measuring the resulting change of the S content of the residual gas in order to compute the current optimal rate of flow of the air has the disadvantage of being slow and not responsive to rapid changes of the process parameters. The third control method, which was developed by the authors, combines the 'feed-forward' and the 'feedback' features of the first two methods. Any variation of the air temperature, T(A) or of the pressure of the 'acid gas', P(GA), is directly corrected by the control equipment in accordance with the formula: delta P(A) equals K.T(A)P(GA).delta P(GA), where delta P is the pressure drop in the orifice used to determine the molar rate of flow. The value of the constant K in the above formula is currently corrected on the basis of measurements of the S content of the residual gas. Two other optimization methods have been tried with a view of improving the response time and of decreasing the amplitude of oscillations due to test inputs.

4578 APTIC NUMBER 14087

NEW PILOT PLANTS TACKLE SO2 POLLUTION. Chem. Eng. News, 44(27): 36-38, July 4, 1966.

By 1980, the coal-fueled electric power industry will produce about 65% of the total sulfur dioxide emission. To meet mounting pressure for conversion to natural gas, coal and power companies are working on facilities for extracting SO2 from stack gases. The most promising of these are embodied in a Japanese pilot plant at Omuta on the island of Kyushu, the Monsanto prototype program at Portland, Pa., and the Bureau of Mines pilot plant at the Pittsburgh Coal Research Center. The Japanese plant will operate a dry catalytic oxidation process on bypass power-plant flue gas.

sulfur dioxide will be oxidized to sulfur trioxide over vanadium pentoxide at 380 to 450 C. Moisture present in the gas will react with the sulfur trioxide to form gaseous sulfuric acid, after which ammonia will be injected into the system to form pure ammonium sulfate crystals. The Monsanto process is an adaptation of the contact catalytic procedure in sulfuric acid production. Gas from coal combustion in the boiler passes first through an electrostatic precipitator for removal of solid fly ash particles. In the next phase, vanadium pentoxide converts 90% of the sulfur dioxide to sulfur trioxide at about 880 F. The Bureau of Mines has developed an alkalized alumina process for absorbing sulfur dioxide from stack gas and recovering elemental sulfur. Desulfurization of coal is considered less promising than these recovery methods, since most coal contains an irreducible minimum of chemically bound sulfur.

4579 APTIC NUMBER 14261

SO2 STACK GAS GIVES (NH4)2SO4. Chem. Eng. News, 44(26):23, June 27, 1966.

Pilot-plant studies are underway in Japan for a dry process for removing sulfur dioxide from stack gases and converting it to saleable ammonium sulfate fertilizer. In the recovery procedure, sulfur dioxide is oxidized to sulfur trioxide over vanadium pentoxide at 380 to 450 C. Moisture in the gas reacts with the sulfur trioxide to form sulfuric acid. Ammonia gas is then injected in the system to form pure ammonium sulfate crystals. The estimated 1966 cost of the process is 0.09 mill per kwh, or 44 cents per metric ton of fuel oil, for a 600-Mw electric power station. The system is expected to obtain 80 to 90% recovery of sulfur dioxide and to produce about 100,000 metric t/yr of ammonium sulfate.

4580 APTIC NUMBER 14200

Coggan, G. C. and J. R. Bourne
THE DESIGN OF GAS ABSORBERS WITH HEAT EFFECTS. PART II: METHODS FOR IMPROVING SEPARATION. Trans. Inst. Chem. Engrs. (London), 47(6):T160 to T165, 1969. 1 ref.

Almost 100 variations of absorption column design or operating conditions were investigated to determine practical methods for increasing the separation of wet and dry methanol feed gases and wet ammonia feed. Data obtained was processed on the English Electric KDF9 computer described in Part I. Results show that the amount of separation that can be achieved in an absorber is governed largely by the rate at which heat can be removed from or absorbed within the system. Interstage coolers and increased values of total flow of the liquid phase/total gas phase flow (L/G), which allow more heat to be removed, together with higher operating pressure (P), which, by partially dehumidifying the feed gas, leads to more evaporative cooling, substantially raise the allowable solute concentration in the feed gas. On the other hand, simply increasing the number of physical stages, i.e., from a 12-stage column with one cooler to one column with 100 stages may have little effect on separation. It is evident that absorbers should not be designed without an investigation of the interacting influences of P, L/G, and the number of coolers on performance. Simply by operating at a pressure of 3 atm and installing three coolers, more methanol can be absorbed in a 12-stage column at L/G equal 0.25 than in a 100-stage column at twice the value of L/G. Ultimate computer design of absorption systems will take into account the capital and operating costs of pressurized absorbers, coolers, distillation columns, and ancillaries. (Author conclusions modified)

4581 APTIC NUMBER 14020

Conlon, E. T. and R. D. Dawson
WHAT YOU CAN DO TO CONTROL AIR POLLUTION. Heating Air Conditioning Contractor, 60(8):30-56, Aug. 1969.

A discussion is presented of the economic opportunities afforded sheet metal contractors as a result of the installations required by the Air Quality Act of 1967 and the public support for control equipment engendered by the Air Pollution Control Association. This is followed by a review of equipment for removing particulates, gases, and vapors and an analysis of factors affecting the design and installation of air pollution control systems. The varied applications of sheet metal to control installations are exemplified by a system for removing carbon particles in a steel plant and another for removing moisture-laden fiberglass particles from a manufacturing plant, both developed by the Columbus (Ohio) Heating and Ventilating Co. A capsule description is included of contaminants present in different types of plants and the type of equipment appropriate for their removal. The need for contractors to take an active role in selling and negotiating contracts is emphasized, especially with regard to providing plant engineers with analyses of both installation and operating costs. Trends toward computer-controlled monitoring systems and toward measuring emissions by the total emission rate, rather than by atmospheric dispersion, imply increasingly larger air pollution control systems, increasingly sophisticated installations, and a growing dollar volume per contract. A purchase agreement which was developed by a contractor to replace standard purchase orders is presented.

4582 APTIC NUMBER 14001

Copeland, A. E., G. N. Haynes, and C. W. Porterfield
FINE COAL CLEANING WITH TABLES. Mining Congr. J., 40(10):44-47, Oct. 1960.

Full-seam mechanical mining produces coal which, due to its increased ash content, requires effective cleaning. Since 1958, this requirement has been met at the preparation plants of the Pocahontas Fuel Co. by means of Deister single-deck or double-deck cleaning tables. The cleaning capacities of these tables are determined primarily by the washability of the raw coal, ash requirements in the clean product, the amount of refuse in the raw feed, and size and ash content in the raw feed. In general, the capacity of the tables is decreased by lower ash requirements in the clean coal, by adverse washability of the raw coal, by an increase in the percentage of refuse, and by increased fines in the raw feed. A comparison of the washabilities of the various size fractions in the raw feed used at Pocahontas shows a good composite washability for raw 3/8-in. slack, the size usually tabled. Coarse sizes, which have a more adverse washability, tend to be cleaned in the first few of the 20 cleaning zones of a table; a large percentage of middle sizes, which have the most favorable washability, comes off further along on the clean coal side of the table; and extreme fines are washed over without any cleaning in the first few zones because of the rush of feed water. Cleaning efficiency drops off at about 50 mesh. Maintenance costs are low for either type table and even lower for a double-deck table, since only one drive mechanism is involved. Similarly, the operating cost of a double-deck table should be one-half that of the single-deck: only one 3-hp motor is required.

4583 APTIC NUMBER 14047

Dalin, George A. and Frederick P. Kober
A HYBRID BATTERY SYSTEM FOR ELECTRIC VEHICLE PROPULSION. Preprint, Society of Automotive Engineers, Inc., New York, 5p., 1969. 1 ref. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690203.)

A hybrid battery consisting of an air-zinc battery and a nickel-zinc battery is proposed for propulsion of an electric vehicle. At this stage of development, the life of the negatives in both batteries is such that periodic replacement is necessary if the target of 500 two-hour cycles over a span of two years is to be achieved. Air electrodes without a noble metal catalyst have a life span which is close to this same figure of 1000 hrs of discharge, especially when protected from high-rate discharge. However, progress is being made in development of the electrode structure and in the catalyst so that a longer life is anticipated. (Author summary modified)

4584 APTIC NUMBER 14268

Dartnell, P. L. and C. L. Goodacre
REDUCTION OF TOXIC AUTOMOTIVE EXHAUST EMISSIONS THROUGH ENGINE DESIGN. (Senkung der Schaedlichen Abgas-Emissionen durch die Gestaltung des Motors). Text in German. ATZ (Automobiltechnische Zeitschrift) (Stuttgart), 71(4):112-116, 1969. 7 refs.

Factors such as increased turbulence of the fuel mixture in the combustion space, lean carburetor setting, limitation of the underpressure in the suction pipe during deceleration while supplying a combustible mixture, as well as valve control time settings and the effect of the shape of the combustion space were investigated with respect to motor power and exhaust gas emission using the U. S. 7-stage test cycle. It is shown that, by taking the above factors into account, it is possible to reduce the emission and to satisfy the present U. S. requirements. The investigations were carried out on a motor of acceptable power, with an improved fuel consumption, without impairing its reliability. A few recommendations are made about factors to be kept in mind in developing a motor, so as to reduce the exhaust gas emission.

4585 APTIC NUMBER 14308

Deal, C. H., Jr. and Michael N. Papadopoulos
METHOD OF REMOVING SULFUR CONTAINING GASES FROM GASEOUS MIXTURES AND RECOVERING SULFUR THEREFROM. (Shell Oil Co., Inc., New York) U. S. Pat. 3,363,989. 7p., Jan. 16, 1968. 6 refs. (Appl. Nov. 4, 1965, 9 claims).

A major object of the invention is to provide a process for the removal of acidic gases over a wide range of partial pressures and subsequent conversion to elemental sulfur with decreased energy requirements and higher process efficiency. Another object is to overcome the disadvantages in the use of previously known absorbents and conversion media, such as the low capacity of absorbent-reactant media for SO2 in the SO2 injection methods, and the lack of thermal stability of many organic solvents. The gaseous acidic mixture containing hydrogen sulfide is contacted with an absorbent-reaction medium comprising an organic sulfone, water, a ferrous salt, and a pyridine carboxylic acid at a temperature of 80-150 F and a pressure of 100-1500 psi. Hydrogen sulfude is removed and a sweet gas is formed. By injecting sulfur dioxide into the hydrogen sulfide-rich absorbent-reaction medium and by maintaining the reaction mixture at a temperature of 325 F, sulfur and water are formed. Sulfur and water are then separated from the absorbent reaction medium. The lean absorbent-reaction medium is recycled to start the process again.

4586 APTIC NUMBER 14029

Deleroi, Werner and Herbert Weh
TRAVELLING BEHAVIOUR AND POWER REQUIREMENT OF BATTERY-DRIVEN ROAD VEHICLES. (Fahrverhalten und Energiebedarf bei Strassen-Elektro-Speicherfahrzeugen). Text in German. Elektrotech. Z. (A), 90(16):383-388, Aug. 1, 1969.

Electric vehicle drive is distinguished particularly by the absence of exhaust gases and has therefore found increasing use in the last few years in towns. A contribution to this development has also been made by the future prospects in the field of electrochemical power supply systems. Power electronics have made possible low-loss control of the drive motors and it therefore appears advisable to give special consideration to technical possibilities of the electrical installation and to the requirements of road traffic. The driving characteristics of a road vehicle and its possible range with the relative storage weight available are dealt with in particular. With the expected increase in power from the use of light batteries, satisfactory ranges and useful weights are obtained, and these make possible economic use of the vehicles. (Author summary modified)

4587 APTIC NUMBER 13966

Dratwa, Heinrich

LOWERING AND ELIMINATION OF DUST AND GAS EMISSIONS. (Verminderung und Beseitigung staub-und gasfoermiger Emissionen).

Text in German. Wasser, Luft Betrieb, 13(5):171-176, May 1969. 49 refs.

A systematic review is made of existing means for lowering the contamination of atmospheric air in confined regions when pollutants are emitted daily in large enough amounts to impair the natural self-cleaning power of the atmosphere. A brief enumeration of typical emission sources is followed by a list of successfully employed measures for lowering the emissions by various modifications of the source processes and by detailed descriptions of dry and wet methods of dust separation, retention methods for undesirable gases, in particular sulfur oxides, and methods of waste gas purification.

4588 APTIC NUMBER 14264

Ebersole, G. D.
HYDROCARBON REACTIVITIES OF MOTOR FUEL EVAPORATION LOSSES.
Preprint, Society of Automotive Engineers, Inc., New York, 8p., 1969. 12 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690089.)

A calculation technique that accounts for nonlinear relations between reactivity and mixture concentration was developed and used to study the hydrocarbon reactivity of evaporation losses from a variety of original fuels. Results of calculated data show that diluting the concentration of light olefins in an original fuel, normally accomplished by additions of butane, pentane, or saturated base stocks, reduces reactivities of hydrocarbon evaporation losses. It was concluded that the effects of fuel composition on evaporation losses is a parallel study needed for complete assessment of the benefits that changes in fuel composition may have on photochemical smog formed from the evaporation losses.

4589 APTIC NUMBER 14294

Ertl, D.
STATE AND FUTURE DEVELOPMENT OF ELECTRIC PRECIPITATORS FOR CENTRAL POWER STATIONS. (Stand und Entwicklung von Elektroentstaubern fuer Grosskraftwerke). Text in German. Mitt. Ver. Grosskesselbesitzer, 49(3):173-179, June 1969. 8 refs.

In the years 1964/65, only 29% of all electrostatic precipitators in the Federal Republic of Germany were designed to reach collection efficiencies of 99% or more; in 1966/67, the percentage rose to 50, and in 1968, 80% of the precipitators reached collection efficiencies of 99.4%. The fraction of precipitators with collection efficiencies of more than 99.5% rose in those years from 24 to 50%. Furthermore, in 1964/65, just 44% of the precipitators were designed for a residual dust concentration in the cleaned gas of less 100 mg/cu m; in 1966/67, 80% of the precipitators were designed to reach that goal. No new plants have been planned in the past two years which do not fulfill the Technical Directives for Clean Air Maintenance recommendations. As collecting electrodes, rolled sheet steel plates are mostly used, and once dust particles are collected, they are not carried away again by the gas flow. The length of the ionizing field has been changed from 6 to 12 m over the last ten years. In some cases, a length of 15 m has been selected. This tendency was not welcomed at first, but as studies of the dependence of collection efficiency on field length show, the latter has no influence whatever. With increasing size of the precipitator, new guide vanes in the form of perforated sheets were required to achieve uniform gas distribution over a large cross section with a minimum of ducts. To avoid bypass gas flow, devices which direct the gas flow repeatedly into the electric field are required.

4590 APTIC NUMBER 13962

Field, Joseph H. and Donald H. McCrea
SO2 REMOVAL METHODS: POSSIBLE APPLICATION TO GASES FROM OIL COMBUSTION. Am. Chem. Soc. Preprints, 13(4):D31-D37, Sept. 1968. 19 refs. (Presented at a Joint Symposium on Pollution Problems due to Sulfur in Petroleum before the Div. Petrol. Chem., the Div. Water, Waste, Air Chem., and the Div. Ind. Eng. Chem., of the Am. Chem. Soc., Atlantic City, N. J., Sept. 8-13, 1968.)

Concern over atmospheric pollution caused by the combustion of oils containing sulfur has focused the attention of the petroleum industry on the removal of SO2 from flue gases. Another aspect of SO2 removal is the potential recovery of sulfur and sulfur compounds. While difficult technical problems are involved in removing SO2 from flue gases, the method has economic advantages over the desulfurization of fuel. The principal wet and dry processes now being investigated in the U. S. are summarized, and cost data are included. Among the wet methods the Wellman-Lord and limestone slurry systems both remove particulate matter as well as sulfur oxides. During the past year, two commercial units were built which involve the injection of limestone into boilers and subsequent wet scrubbing. The limestone slurry system is thus the most highly developed process in the country. Development of dry processes that avoid cooling flue gases is continuing. Pulverized coal-firing injection of limestone into a furnace requires less space and lower capital costs than other SO2 removal methods. There are indications, however, that a higher degree of removal is obtained in an oil-fired unit using the same amount of limestone. Large-scale tests by TVA will provide technical and cost data for users of the limestone-injection process. Catalytic oxidation of SO2 to SO3, with subsequent removal of sulfuric acid, is being investigated by Monsanto. Pilot plant tests of the alkalized alumina process developed by the U. S. Bureau of Mines continue. Because of the capital costs and space requirements, there is little interest in the commercial application of the carbon sorption process.

4591 APTIC NUMBER 14004

Franzky, Ulrich
COUNTERACTING OFFENSIVE ODORS CAUSED BY ORGANIC COMPOUNDS. (Bekaempfung von Geruchsbelaestigungen, die durch organische

Verbindungen verursacht sind). Text in German. Staub, Reinhaltung Luft, 28(3):113-119, March 1968. 13 refs.

The importance of removing odorous components from waste air and exhaust gases is now recognized, but the selection of an appropriate purification process is complicated by the proliferation of chemical processes and treatment methods. A survey of the most popular methods is given and measures that can be taken to improve conditions in a small plant are pointed out. (Author summary modified)

4592 APTIC NUMBER 14110

Galeano, Sergio F.
REMOVAL AND RECOVERY OF SULFUR DIOXIDE IN THE PULP MILL INDUSTRY. Florida Univ., Thesis (Ph. D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1966, 239p. 149 refs.

Technical and economic feasibilities of a purification system for the removal of sulfur dioxide in pulp mills were studied. Applications in both kraft and neutral semichemical systems are offered. An experimental pilot plant with a capacity of 2800 cfm consisting of a venturi scrubber and a cyclone was used in the various experiments. The pilot plant was designed for use as a purification system for either the kraft or the semichemical systems. Two different scrubbing solutions were used. A carbonate solution proved technically feasible in the semichemical process. Sulfur dioxide removals in excess of 90% were obtained. Weak black liquor, obtained before it reached the evaporators, was used in the kraft process. Sulfur dioxide removal was again in excess of 90%. A venturi-cyclone combination and a spray chamber with radial inlet and lateral sprayers were studied using both the carbonate solution and weak black liquor as scrubbing solutions. The proposed system was found to be both technically and economically feasible for the carbonate scrubbing solution in the semichemical process. The use of weak black liquor as a scrubbing solution in the kraft process proved to be technically feasible. Its economy is a matter of more flexibility dictated by the particular conditions of each plant. (Author abstract modified)

4593 APTIC NUMBER 14054

Ganz, S. N.
ABSORPTION OF NITROGEN OXIDES BY SOLID ABSORBENTS. PART I. (Pogloshcheniye okislov azota tverdymi sorbentami. Soobshcheniye I). Text in Russian. Zh. Prikl. Khim., vol. 31:138-140, 1958. 5 refs.

In a search for an effective solid absorbent for low-concentration (0.3-0.25%) nitrogen oxides, experimental studies were made with activated carbon, aluminum silicate, silica gel, manganese dioxide, cupric oxide, hopcalite, and coke in conjunction with industrial gas from a nitric acid plant. Data reflecting the relative effectiveness of these absorbents are plotted and indicate the descending order given above. Hopcalite, MnO_2, CuO and coke were difficult to regenerate, the first three of these being unsuitable because of the chemical nature of their action. Complete desorption of nitrogen oxides from carbon, aluminum silicate, and silica gel is difficult, requiring temperatures on the order of 200-350 C. Aluminum silicate is regarded as the most suitable material based on its sufficiently high absorbing capability, high mechanical strength, and ability to undergo high-temperature regeneration.

4594 APTIC NUMBER 14199

ARGUMENTS IN FAVOR OF THE USE OF NATURAL GAS IN THE STRUGGLE AGAINST ATMOSPHERIC POLLUTION. Gas (The Hague), 89(9):389-393, Sept. 1969.

Air pollution is not equally acute in all countries. It is influenced by the degree of economic development and by the local climatic and topographical conditions. This explains the great difference in the levels of public awareness in various countries. The causes and consequences of air pollution and the main legislative efforts of Belgium, France, the United Kingdom, Italy, the Netherlands, Germany, and the United States are reviewed. The arguments for the use of natural gas as a factor in combating air pollution are given. They include the fact that natural gas is a clean fuel and not toxic. Natural gas produces no smoke when burned and is usable without previous processing. It can be transported almost entirely underground and is a form of energy perfectly adapted to urban comfort and would contribute to the protection of monuments and vegetation. Several ways are open to the gas industry for stimulating the use of natural gas. Reference should be made to anti-pollution legislation where it exists. Action could be taken to convince the public through classic media to use natural gas and convince the decision makers that natural gas can open up markets all over the world. In one country, even in one city, the effects of air pollution may not be uniform. The policy of the gas industry should therefore be very flexible and adaptable to local conditions, such as the actual level of pollution, the existence or lack of legislation, and the sensitivity of consumers and the general public to the problem of air pollution.

4595 APTIC NUMBER 14183

Guepner, O.
PROBLEMS OF DUST REMOVAL FROM THE EXIT GASES OF HEAT-EXCHANGER KILNS FROM THE VIEWPOINT OF ELECTROSTATIC PRECIPITATOR CONSTRUCTION. (Problematik der Abgasentstaubung von Waermetauscheroefen aus der Sicht des Elektrofilterbaues). Text in German. Zement-Kalk-Gips (Wiesbaden), 57(5):199-208, May 1968. 15 refs.

The mode of operation and the specific characteristics of an electrostatic dust precipitator are discussed. The different types of behavior of electrostatic precipitators placed after the heat-exchanger kilns with various gas circulation schemes are also discussed. An interpretation of these differences based on differences of dust resistance, is compared with the results and knowledge gained in practice. Various possibilities of improving the specific filter action are then discussed. The resulting recommendation that an evaporative cooler should be installed ahead of the electrostatic precipitator is elucidated from an engineering point of view. Finally, a comparison of the initial costs of installations with and without evaporative coolers is given.

4596 APTIC NUMBER 14030

Guyot, G.
S.N.P.A. PROCESS FOR THE TREATMENT OF RESIDUAL GASES WITH LOW CONCENTRATION IN SO_2. (Procede developpe par la Societe Nationale des Petroles d'Aquitaine pour traiter des gaz residuaires charges de faibles teneurs de SO_2). Text in French. Chim. Ind. (Paris), 101(1):31-34, Jan. 1969.

The sulfuric acid plant of the Societe Nationale des Petroles d'Aquitaine at Lacq is able to produce a sulfuric acid with a concentration of 94% from gases containing only 1.5% by volume of SO_2 and H_2S, and 30% water vapor. The process involves the oxidation of H_2S to SO_2, followed by the oxidation of SO_2 to SO_3 on a vanadium catalyst in an adiabatic reactor, gas-liquid contact in a bed of Raschig rings, and, finally, the absorption of SO_3 by diluted acid circulated and cooled in graphite exchangers. After leaving the absorption unit, the gas is passed through a Teflon filter which retains any drops of acid that are carried along with the gas. To avoid the condensation of acid in the chimney, gases are lightly heated before being exhausted into the atmosphere. Gases emitted from the plant contain 75 mg/cu m SO_3 at the most.

4597 APTIC NUMBER 14123

Haferkorn, R., K. E. Schneweis, and H. Brandis
COMPARATIVE INVESTIGATIONS ON THE METHODS OF IDENTIFICATION OF BACTERIOPHAGES FROM AEROSOLS AS WELL AS ON THE RETAINING CAPACITY OF FILTERS AND IMPINGERS FOR BACTERIOPHAGE AEROSOLS. (Vergleichende Untersuchungen uber Nachweisverfahren von Bakteriophagen aus Aerosolen sowie uber das Ruckhaltevermogen von Filtern und Impingern fur Bakteriophagenaerosole). Text in German. Arch. Hyg. Bakteriol. (Munich), 152(2):97-106, April 1968. 8 refs.

Comparative measurements were made to determine the retaining capacity and sensitivity of various traps for aerosols of T3 phages. The retaining capacity of impingers (Djakonow apparatus and all-glass impinger) was found to be the lowest of all traps tested. Their average permeability was 30%. The following values were found for the permeability of filters: gelatine filter 0.004 to 0.011%, microsorban filter 0.00014%, membrane filter 0.00001 to 0.00003%. When the detecting capacity of the impingers (usually 15 to 60%) was taken as 100%, detecting sensitivities of 74% for gelatine filters and 15% for membrane filters were obtained. Gelatine filters are the most suitable samplers where good retaining power with high detecting sensitivity is required. (Author summary modified)

4598 APTIC NUMBER 14142

Harding, K. W. and W. C. Jones
THE COST OF HIGH-EFFICIENCY AIR FILTERS. J. Inst. Heating Ventilating Engrs. (London), vol. 37:88-91, 96, July 1969. 1 ref.

An increasing number of industries find it necessary to protect their manufacturing or experimental areas against both inert dirt particles generated within process areas and against periodic radioactive dust fallout. Such standards of air filtration require high-efficiency particulate (HEPA) filters consisting, as a rule, of fiber-glass paper folded into pleats around corrugated aluminum or paper separators and sealed in plywood or metal housing. Since they are not cleanable, the filters are discarded when loaded with dirt to a pressure drop that renders them uneconomical. Filters are available in a number of combinations. Assuming that in each combination the cells are replaced when the optimum terminal pressure drop is reached, the total 1969 operating cost of HEPA filters ranges from about 50 to 70 pounds sterling per 1000 cu ft/min/year (8760 hrs). The cheapest form of disposable high-efficiency filtration appears to be HEPA cells rated at 50% of the nominal face velocity and changed at a terminal pressure drop of 2.5 in. wg. However, an installation of this type requires a large building volume. The cheapest combination of filters would consist of HEPA cells at nominal rating preceded by an electrostatic prefilter. Other combinations of filters employing HEPA cells at their nominal rating of 250 ft/min face velocity cost slightly more to operate, whether prefiltered or not. The best of these appears to be a roughing filter of the panel or automatic roll type, which should extend the base life of the HEPA cell. At atmospheric dust loads lighter than 4.5 mg per 1000 cu ft/min, the operating cost of a replaceable cell system may be cheaper than the electrostatic combination.

4599 APTIC NUMBER 14326

Hardison, L. C.
A SUMMARY OF THE USE OF CATALYSTS FOR STATIONARY EMISSION SOURCE CONTROL. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 271-296.

Catalysts have been used for about 20 years for oxidizing hydrocarbons to prevent their emission into the atmosphere. Initially, all-metal catalysts of the Suter-Wuff type, in which the active catalytic material is conducted to the surface of a base metal support by means of an electrochemical process were used; they were most commonly of the platinum-palladium group. These continue to be the most widely used catalysts for stationary source control, but ceramic honeycomb-supported and particulate-supported catalysts have had significant application. Particulate catalysts are widely used in petroleum refining and chemical processes, and to a limited extent in air correction. Ceramic honeycomb materials have an advantage over particulate catalysts in that the pressure drop for a given amount of ceramic surface area is only a very small fraction of that across the particulates. While the scientific basis of catalysis is not as clear as that of many of the other industrial arts, the thermodynamics are sufficiently well known that catalysts can be characterized with good success. A summary of the thermodynamic reactions involved in catalysis is given. The use of catalytic air pollution control equipment in such industries as wire enameling, kettle cooking (particularly in paint manufacturing), metal lithographing, the chemical process industries and many others is described. Additional applications for catalytic air pollution control continue to appear as regulations and community standards for air quality become more rigid. An appendix presents a sample computer analysis of catalytic solvent burning.

4600 APTIC NUMBER 14031

Harris, Samuel W., Edwin F. Morello, and Gavin H. Peters
PROCESS FOR DECOMPOSITION OF OXIDES OF NITROGEN. (Standard Oil Co. Inc., Chicago) U. S. Pat. 3,459,494. 2p., Aug. 5, 1969. 4 refs. (Dec. 14, 1966, 10 claims).

A process is claimed that can provide as high as 98 to 100% decomposition of nitrogen oxides into nitrogen and oxygen. The method consists of contacting nitrogen oxides with a high-melting solid catalyst selected from at least one member of the group comprised of alkali metal oxides, alkali metal silicates, alkaline earth metal oxides, alkaline earth metal silicates, and mixtures of these, at a temperature above 700 C for a time sufficient to accomplish the conversion. The contact of the nitrogen oxides with the catalyst should take place between about 700 C and 1100 C, and preferably between 800 C and 1000 C. The degree of decomposition will depend upon the particular catalyst and temperature used. Operating details and possible variations of the process are described. The effectiveness of the method contradicts previous assumptions of the great difficulty of carrying out such decomposition, and by eliminating the use of platinum and paladium as catalysts, reduces the cost and adds to the commercial significance of this conversion technique. The high degree of conversion would make possible the use of the resulting air mixture for human consumption; by producing a breathable, oxygen-enriched atmosphere, the process may have applications in space travel, reduction of air pollution from industrial gas streams, purification of automobile exhaust gases, and reduced smog formation. For example a modification of the process is described which produces automobile exhaust emissions substantially free of all harmful nitrogen oxides; it is also contemplated that by use of this method, solid ammonium nitrate grains may be used as the source of nitrogen oxides in space exploration.

4601 APTIC NUMBER 14046

Havens, T. F.
TRUCK EMISSION CONTROL. Preprint, Society of Automotive Engineers, Inc., New York, 8p., 1969. 5 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich, Jan. 13-17, 1969, Paper 690164.)

Emission control standards for trucks are becoming more stringent, thus making it necessary to develop new devices to control emissions. The positive ventilation system, used on heavy-duty trucks for many years to reduce crankcase condensation and sludging, appeared to be a practical method of eliminating the blowby emission to the atmosphere. Adaptations of this system were made for passenger cars and light trucks. This system virtually eliminated all crankcase emissions. Revised exterior components were necessary for exhaust emission control. In addition, internal engine changes, combustion chambers, valve porting, and valve timing revisions were required. The system used on heavy trucks to control exhaust emissions was similar to that used on light-duty vehicles. Air injection and engine modification methods were used. Two basic vapor storage methods are under consideration to prevent evaporation loss. Both of these systems result in introducing additional fuel to the engine during certain modes of engine operation. A significant change in the vehicle, due to the incorporation of the evaporative control system, involves revisions to fuel tank vent systems to direct tank vapors to the storage chamber. Control methods to decrease diesel smoke emissions will be primarily incorporated into the injection system of these engines. In order to ensure continued emission control, control systems in use must receive proper maintenance.

4602 APTIC NUMBER 14322

Hein, L. B., A. B. Phillips, and R. D. Young
RECOVERY OF SULFUR DIOXIDE FROM COAL COMBUSTION STACK GASES. Problems and Control of Air Pollution Frederick S. Mallette (ed.), New York, Reinhold, 1955, Chapt. 15, p. 155-169. (Also in: TVA, Wilson Dam, Alabama, Monthly Rept. 47-A, p. 63-74, March 1955. 12 refs).

Pilot-plant data was obtained with actual combustion gas from high-sulfur coal for evaluation of the process for the recovery of sulfur dioxide from dilute gases. The objective was to establish the effects of the operating variables that are important in evaluating the process. The major variables studied were the recirculation rate, pH, concentration of the scrubbing liquor, depth of packing, and gas velocity in the scrubber. The pilot plant consisted of equipment for burning pulverized coal, for cooling and humidifying the gas, and equipment for scrubbing the gas with an ammonium sulfite-bisulfite solution. The effect of recirculation rate on the recovery of sulfur dioxide showed increased recovery with increased recirculation rate up to 5 gal/min and leveled off above this value. The recovery of sulfur dioxide decreased markedly below, a pH of 6.3 and loss of ammonia became increasingly pronounced as the pH was raised. The liquor reciculation rate required to obtain a given recovery increased as the depth of packing was decreased. There was no significant change in the recovery of sulfur dioxide as a function of superficial gas velocity. Tests showed that the recovery of sulfur dioxide decreased and loss of ammonia increased as the concentration of the scrubbing liquor was increased. Data showed that the humidifer was effective in removing both dust and sulfur trioxide from the gas. Virtually all of the ammonia can be recovered from the scrubber exit gas by scrubbing with dilute ammonium sulfite-bisulfite solution in a second-stage tower. The results indicated that the ammonia scrubbing process can be used to recover large percentages of sulfur dioxide in stack gas and is operable over a fairly wide range of conditions, which should make it easy to control and should permit variation of the process for a specific installation.

4603 APTIC NUMBER 14297

Hind, C. J.
CLEAN AIR AND THE DIESEL. Indian Eastern Engr. (Bombay), 111(2):77-79, Feb. 1969.

A defense of the diesel engine against criticism that it is a heavy contributor to air pollution is presented. Under ideal conditions if all gasoline engines were replaced by diesel engines, the emission of carbon monoxide, aldehydes, and nitrogen oxides would be reduced, carbon dioxide, hydrocarbons, and soot would be increased, and sulfur dioxide would be unchanged. Carbon dioxide is not seen as a health hazard, and hydrocarbons are not considered dangerous, as they are in parts of the U. S., because the other conditions necessary for the creation of photochemical smog, particularly climatic factors, are not present in the U.K. Carbon monoxide, possibly the emission most hazardous to health, would be reduced to almost negligible amounts. Sulfur dioxide would necessarily be kept to a minimum, since in diesel engines the sulfur content of the fuel is deliberately kept very low to reduce internal corrosion of engines. In addition, because the diesel engine is more efficient than the gasoline engine, the absolute quantity of fuel oil used would be reduced, thus lowering the total impurities discharged into the atmosphere. Efforts are underway to reduce the major pollutants from diesels: smoke (carbon) and odor (sulfur dioxide). Supercharging by making use of energy remaining in the exhaust gases to drive a turbine and compressor, is seen as one way of maintaining a satisfactory fuel/air ratio for smokeless operation and greater efficiency as fuel input is increased. Improvements in the combustion process are being investigated as an engineering goal and to reduce odorous emissions.

4604 APTIC NUMBER 14007

Hsieh, Yu Hsioh
AN EXPERIMENT IN THE PRODUCTION OF NITROGEN FROM NITRIC ACID PLANT TAIL GAS. (Ts'ung hsiao suan wei ch'i chih ch'i t'an ch'i ti shih yen). Text in Chinese. K'o Hsueh T'ung Pao, vol. 10: 307-308, 1957. 6 refs.

By passing nitric acid tail gas first an alkali scrubbing tower to remove CO_2 and then through a catalyst reactor to reduce NO_2 and O_2 in the presence of excess hydrogen, it was found practical to recover nitrogen. Three types of catalysts were made by depositing Cu and Ni on soil diatoms: CuO:diatoms, NiO:diatoms, and CuO plus NiO:diatoms, all in a 1:9 ratio. The highest absorption rate could be attained with a sodium hydroxide concentration of 1% and a gas linear velocity of 0.2 m/sec. The concentration of CO_2 could be reduced to 30 ppm. By using CuO with a firebrick carrier at a temperature of 600-650 C, a space velocity of 6000 reciprocal hours, and 4-6% excess hydrogen, it was possible to produce a gas with 1-5 ppm NO, 10-20 ppm O_2, and 400 ppm NH_3. By using the copper-nickel catalyst with diatoms as carriers at a temperature of 300-500 C, a space velocity of 1500 reciprocal hours, and 5% excess hydrogen, a gas with 0.4-0.7 ppm NO, 10-20 ppm O_2, and 300-500 ppm NH_3 could be produced with the content of noxious gas within acceptable limits. The temperature of reaction increases rapidly with oxygen content of the tail gas and with space velocity. Since the reactor was of simple construction, there was no way to control the temperature, and no tests were performed under conditions of low temperature and high space velocity.

4605 APTIC NUMBER 14327

Hubbard, John E.
VEHICLE AND ENGINE VARIABLES INFLUENCING THE PERFORMANCE OF CATALYTIC CONVERTERS FOR DIESEL EMISSIONS CONTROL. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968. p. 252-270.

Two engine variables which affect a catalytic muffler are discussed. Temperature and particularly back pressure directly relate to the level of smoke control in the diesel engine. One series of development tests on mufflers used vertical beds which exhibited high back pressure build-up. A fuel additive was used on a weekly basis as a purging means with some noticeable effect in back pressure drop. Various methods of purging the catalyst were tried and all were time consuming, costly, and impractical from the operator's standpoint. In order to avoid water purging, barium sulfonate was added to vertical bed mufflers. Some reduction in back pressure drop was noted and no catalytic poisoning of the pellets by barium appeared. In another series of tests, 40 and 60-lb catalyst beds were used; the rate of back pressure drop was greater on the smaller bed. It was suggested that this result was due to the higher constant air flows that agitated the bed and kept it cleaner. Lower smoke levels on diesel engines indicates another reason why catalyst beds are not plugging. This lower smoke level is primarily possible through the use of new needle valve injectors. A muffler was redesigned with a horizontal bed to take advantage of the catalyst bed agitation. Soot on the pellets from the catalytic mufflers was examined and found to be dry, containing less than 1% of benzene-soluble material. From the standpoint of maintaining clean catalyst beds a higher bed temperature would be desirable but not possible in diesel exhausts. Tests with thermocouples in the bed were run in order to observe the temperature effect of loads on the catalyst. It was concluded that even using only peak periods of temperature for accelerations, some of the heat is retained in the bed until the next acceleration and is not entirely expelled into the atmosphere. Work is being done to improve catalyst muffler performance.

4606 APTIC NUMBER 14309

Hunter, J. B.
PLATINUM CATALYSTS AND AIR POLLUTION CONTROL. S. African Mining Eng. J., 1968:438-440, Feb. 23, 1968. 1 ref.

A ceramic platinum catalyst support in the form of a honeycomb-like structure is described. The catalyst is a highly active platinum tightly anchored to a ceramic base by a new proprietary technique. This concept in catalyst packaging not only protects the ceramic structure against breakage but also allows for catalyst interchangeability. These catalysts were found to be useful in eliminating nitrogen oxide fumes in systems where natural gas and purge gas were used as fuels. Examination of the catalyst after six months of operation showed no sign of deterioration. The catalysts were found to be effective for complete oxidation of organic contaminants and also in nuclear power installations where intense radiation causes the decomposition of water and the gradual rise in concentration of a hydrogen/oxygen mixture in a closed loop system. A major advantage of the honeycomb catalyst is its exceptionally low pressure drop. Other advantages include more uniform gas distribution, greater structural strength, no attrition or loss of fines, and no channelling or hot spots. From the standpoint of system design, the rigid structure also provides greater process flexibility.

4607 APTIC NUMBER 13983

Idel'chik, I. Ye., V. P. Aleksandrov, and E. I. Kogan
STUDY OF DIRECT-FLOW CYCLONES FOR A GRES ASH-TRAPPING SYSTEM. (Issledovaniye pryamotochnykh tsiklonov sistemy zoloulavlivaniya GRES). Text in Russian. Teploenergetika, no. 8:45-48, Aug. 1968.

A direct-flow cyclone for a GRES (state regional electrostation) ash-trapping system was tested under laboratory and industrial conditions both in a self-draughting arrangement without an intermediate cyclone, and with a forced draught and an intermediate cyclone to remove dust. The four cyclone variants tested have a diameter of 350 mm and are described. The optimum variant (conoidal rosette with a flow gathering angle of 24 deg) gave a purification coefficient of 61% (as compared to 49% for the basic variant), but the hydraulic drag coefficient was significantly increased. The following dependences are plotted: purification coefficient vs degree of suction; purification factor vs average flow velocity; and fractional purification factor vs particle size.

4608 APTIC NUMBER 14203

Iida, Suetoshi, Yoshio Harushima, and Nobuyasu Hasebe
METHOD FOR THE REMOVAL OF HYDROGEN SULFIDE IN THE AIR OF WASTE GAS. (Tokyo Gas Kabushiki Kaisha, Inc., Tokyo) U. S. Pat. 3,459,495. 4p., Aug. 5, 1969. 3 refs. (Nov. 4, 1965, 5 claims).

A method is described for removing hydrogen sulfide from the air or from combustible waste gases by a wet process and recovering sulfur. The method comprises passing hydrogen sulfide-containing gases through an aqueous alkaline medium containing an amount between 0.001 to 0.5 moles of sodium 1,4-naphthoquinone-2-sulfonate in the presence of molecular oxygen, thereby desulfurizing the hydrogen sulfide-containing gases and at the same time regenerating the catalytic naphthoquinone. Thus, the method, by introducing an acidic radical into quinones, hydroquinones, or their salts, employs as an absorption liquid an aqueous solution of a catalytic compounds, the normal oxidation-reduction potential of which is in the range from 0.45 to 0.70 v at 25 C. The catalytic compound is water-soluble, not polymerizable, and must be easily reduced by hydrogen sulfide; this reduced compound must in turn be easily oxidized by the air. The method is considered applicable to the desulfurization of hydrogen sulfide-contaminated air, to contaminated exhaust gases from certain chemical plants, and to combustible gases from the fermentative treatment of biological and other waste products. Details of the process and of the chemical reactions involved are presented.

4609 APTIC NUMBER 14194

Ito, F.
AN EXAMPLE OF SMOKE PREVENTION FOR COAL FIRING APPARATUS OF STEAM JET TYPE. (Joki funshashiki sekitan nensho sochi ni yoru baien boshi no jitsurei). Text in Japanese. Netsu Kanri (Heat Engineering) (Tokyo), 20(2):32-36, Feb. 1968.

A steam jet coal-firing apparatus reduced dust from 2.26 to 0.27 g/cu m, eliminated black smoke, increased heat efficiency to 50%, and lowered exhaust gas temperatures from 329 to 307 C. Coal content of dust dropped from 12.2 to 8.5%. The size of the apparatus and the number of jets depend on the individual boiler. The inner diameter of the apparatus ranges from approximately 3 to 6 mm and nozzle height from 450 to 650 mm. Steam pressure requirements vary from 0.7 to 1.5 kg/sq cm. Preferably, boiler pressure should be above 4 kg/sq cm. Cost of the apparatus is calculated at 300,000 yen (1968) for pressure less than 4 kg/sq cm and a heat transfer area greater than 15 sq m; at 250,000 yen for pressure less than 4 kg/sq cm and a heat transfer area less than 15 sq m; at 120,000 yen for pressure above 4 kg/sq cm and with a heater; and at 30,000 yen for pressure above 4 kg/sq cm but without a heater.

4610 APTIC NUMBER 14254

Joyce, Ronald S., Paul D. Langston, George B. Stoneburner, Charles B. Stunkard, and George S. Tobias
ACTIVATED CARBON FOR EFFECTIVE CONTROL OF EVAPORATIVE LOSSES. Preprint, Society of Automotive Engineers, Inc., New York, 12p., 1969. 5 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690086.)

An activated carbon used in an evaporative loss control system should have as high a working capacity as practical. This property is related to the pore size distribution, which can be modified to meet the regeneration requirements peculiar to the automobile environment. High saturation capacity is also a desirable feature in that it provides a safety factor for the accumulation of high molecular weight constituents that are strongly adsorbed. The selection of the carbon must also be influenced by its hardness or attrition resistance. Carbons are available commercially with a practical working capacity and with the hardness characteristics necessary to withstand the vibrations encountered in vehicle use. Commercially available activated carbon has the ability to effect the storage and release of hydrocarbon vapor over an extended period of time. The results indicated that by sizing the carbon unit on the basis of the amount of evaporation anticipated and an effective working capacity of 50% of the virgin carbon level, the carbon can last for five years and probably longer. For systems incorporating throw away carbon modules, less stringent capacity safety factors will likely be required. No evidence has been found that air purging at the temperatures likely to be employed has any detrimental effect on the carbon structure or that air-hydrocarbon interactions on the carbon surface lead to irreversible fouling. The working capacity of an evaporative loss device, containing any given carbon, will be governed by the volume of purge air used and by the adsorption-desorption temperature differential. These factors should be considered in the design of an effective system. (Author summary modified)

4611 APTIC NUMBER 13986

Kempe, Werner
INVESTIGATIONS OF PURIFICATION OF WASTE GASES OF VERTICAL LIME KILNS. (Untersuchungen zur Reinigung von Abgasen aus Kalkschachtoefen). Text in German. Neue Huette, 14(2):86-89, Feb. 1969. 3 refs.

The relationship between degree of separation and power requirement in a wet dust removal process is briefly discussed and tests on an experimental venturi installation for purification of lime kiln waste gases are described. The dependence of the degree of dust separation on the pressure drop in the orifice at different gas speeds between 30 and 114 m/sec and the different water additions (0.6 and 1.2 liters/cu m) were investigated. The results obtained are in accord with the known functional relationship between degree of separation and contact power. The dust content of 10 mg/cu m of the purified gas, repeatedly attained at a pressure drop of 900 mm H2O, attests to the positive outcome of the tests. The investigations were carried out at the request of a German soda manufacturer.

4612 APTIC NUMBER 14095

Kercher, H.
FLUE GAS DUST REMOVAL. Brennstoff-Waerme-Kraft, 19(4):196-197, April 1967. 37 refs. Translated from German by E. J. Lachner.

Various devices for reducing dust emission due to flue gases are described. The use of cyclone dust collection for removing dust is applicable mainly to fixed units with small- and medium-sized grates. Considerable improvement in separation efficiency has been achieved by the introduction of the multiple cyclone method of construction. Cyclone separators have low installation costs but are subject to increased wear due to the high velocity of the gas/air dispersion in the cyclone. Cloth filters for dust removal from large steam generators become very large and expensive. However, if the filter fabric is properly chosen, it can endure the flue gas temperatures and be used with good efficiency for small installations for cleaning flue gases difficult to filter. The specific electric resistivity of the dust has a great influence on the separability of dust in an electrostatic filter. A low specific resistivity lowers the separation capacity. Very high specific resistivity results in re-ionization at the fallout plate and also decreases the separation. When monitoring the operational efficiency of electrostatic filters, measuring instruments for dust content, built into the clean gas side of the filter, have proven very effective. Although the initial cost of an electrostatic filter is high, its operating and maintenance costs are low.

4613 APTIC NUMBER 14057

Ketov, A. N., V. V. Larikov, V. V. Pechkovskiy, and A. S. Shligerskiy
DRY LIME METHOD FOR REMOVING SULFUR DIOXIDE FROM TETS FLUE GAS. (Sukhoy izvestkovyy sposob ochistki topochnykh gazov TETS ot sernistogo angidrida). Text in Russian. Zh. Prikl. Khim., 41(4):725-729, 1968. 3 refs.

Crushed coal containing 3.76% sulfur was burned under laboratory conditions at a rate of 2.8 g/min, and an intermediate industrial product containing 5.97% sulfur was burned at 3.49 g/min, to determine factors affecting SO2 removal from TETS (heat and electric power plant) flue gas by the dry lime method. Sulfur dioxide removal at furnace temperatures of 1100-1200 C reached 50-60% with stoichiometric addition of lime. An excess air factor of 1.15 with 10-20% excess lime is recommended. The experimental arrangement is described and data are tabulated.

4614 APTIC NUMBER 14222

Ketov, A. N., V. V. Larikov, and A. S. Shligerskii
INFLUENCE OF THE NATURE AND PRELIMINARY TREATMENT OF THE REAGENT ON THE DEGREE OF PURIFICATION OF GASSES. J. Appl. Chem. USSR (English translation from Russian of: Zh. Prikl. Khim.), 41(5):1062-1064, May 1968. 2 refs. (Communication III in the series on removal of sulfur dioxide from the flue gases of heat and power plants.)

Chalk, limestone, pure calcium carbonate and calcium oxide, and calcium oxide made by the thermal decomposition of these products were tested as reagents for the lime process of sulfur dioxide absorption from coal gas. The degrees of purification obtained with chalk, limestone, and pure calcium carbonate ranged from 47 to 85% and were two to three times higher than those obtained with the calcium oxide derived from thermal decomposition. Chalk had the highest absorption capacity of the carbonate group and pure CaCO3 the lowest. Differences between degrees of purification in the calcium oxide group were not large. In both groups, the degree of purification was proportional to the specific surface of the reagent. Accordingly, chalk has the greatest specific surface and gives the highest degree of purification. When carbonate is used as a reagent, reaction rate and purification are influenced by the carbon dioxide formed during dissociation of the carbonate. To achieve a high degree of SO2 removal, it is necessary to superimpose in time and space the process of the thermal dissociation of limestone and formation of calcium sulfate. This can be achieved in industrial plants by blowing chalk or limestone into the boiler furnace separately from the fuel through special nozzles. The process should be conducted at 1100 to 1200 deg.

4615 APTIC NUMBER 14205

Kettner, Helmut
THE REMOVAL OF SULFUR DIOXIDE FROM FLUE GASES. Bull. World Health Organ. (Geneva), 32(3):421-429, 1965. 5 refs.

Various processes for cleaning flue gases and details of new methods are described. Wet scrubbing with water, though widely practiced, has many disadvantages. Scrubbing with zinc oxide, feasible in zinc works, is more satisfactory. Dry methods use a solid absorbent; they have the advantage of a high emission temperature. Other methods are based on the addition to the fuel or the flue gases of substances such as activated metal oxides, which react with the sulfur to form compounds less harmful than sulfur dioxide. Also being investigated are a two-stage combustion system, in which the sulfur dioxide is removed in the first stage, and the injection of activated powdered dolomite into burning fuel followed by electrostatic precipitation of the resulting sulfates. A wet catalysis process has recently been developed. Most of the cleaning process are not yet technically refined, but first results show good efficiency and relatively low cost. (Author abstract modified)

4616 APTIC NUMBER 14280

Khan, A. A., R. V. Amalraj, and S. Ramachandran
APPLICATION OF THEORY OF FILTRATION ON A SPECIFIC QUALITY OF ASBESTOS. Bhabha Atomic Research Centre, Bombay, India, Waste Treatment Div., B.A.R.C.-351, 30p., 1968. 2 refs.
CFSTI: N69-28114

The resistance characteristics of a typical indigenous Indian asbestos fiber were investigated as part of a study to determine the suitability of these fibers for the production of high-efficiency air filters for industrial use in particulate removal. An attempt was made to calculate the mean fiber radius within a filter, to which single-fiber mathematics could then be applied for greater ease in predicting fiber performance in a filter system. Certain characteristics of the fiber were determined experimentally on the basis of Darcy's Constant, including volume flow rate, depth of the bed, viscosity of air, cross sectional area of the fibrous bed, and specific gravity. The method consisted of dispersing asbestos fiber in a mixer to form a bed of known basic weight. Water in the bed was removed by suction; the bed was then dried and a known amount of air forced through at a constant pressure difference, by means of a densometer. Thickness of the bed was measured by a travelling microscope; its thickness, size, weight, and density were used to estimate its porosity. These characteristics were then applied to various equations which use measurement of pressure drop across a filter in order to determine mean fiber radius; the equations of Sullivan and Hertel, Davies, Langmuir, and Iberall were included. It was found that Langmuir's equation gave results which agreed most closely with estimates made from microscopic observation. Tabular data presenting the results of all experimental procedures and calculations are included.

4617 APTIC NUMBER 14302

Kiyoura, Reisaku and Andy C. Santore
OIL DESULFURIZATION BOOSTS JAPANESE SULFUR PRODUCTION. Bull. Tokyo Inst. Technol., no. 94:31-38, 1969. (Also: Oil Gas J., 66(35):126, 1968).

By Dec. 1970, Japanese producers will recover 500 tons/day of sulfur from light oil desulfurization. By April 1971, recovery from residual and vacuum oil desulfurization should reach 1722 tons/day. Idemitsu Oil's desulfurization plant at Chiba is the first in commercial operation. Built at a cost of more than $19 million, the plant has a b/sd capacity of 40,000 and a sulfur recovery capacity of 180 tons/day. Twenty additional tons/day will be produced from light oil desulfurization. The Chiba operation utilizes Middle East crude oil averaging 2.2% sulfur. The resulting residual fuel oil from refining contains 3.9% sulfur. With the UOP-HCD Isomax equipment used at Chiba, the resulting product contains only 1% sulfur. Based on sulfur prices of $36 and $50, the cost of a residual desulfurization process for a plant of 45,000 b/sd capacity is $2.8/kl and $2.5/kl, respectively. A comparison of projected sulfur recovery and sulfur dioxide emissions indicates that total sulfur recovery is not imminent. By 1970, 4.7 million tons of SO2 will be emitted and 1.3 million tons recovered; by 1975, 6.4 million tons will be emitted and 2.6 million tons recovered.

4618 APTIC NUMBER 14093

Kopa, R. D., R. G. Jewell, and R. V. Spangler
EFFECT OF EXHAUST GAS RECIRCULATION ON AUTOMOTIVE RING WEAR. J. Air Pollution Control Assoc., 12(5):246, 247-254, May 1962. 6 refs.

As a means of controlling nitrogen oxides in automobile exhausts, it was found that exhaust gas recycling offers an effective method of controlling combustion temperature with the result that less nitrogen oxides are formed. To determine how exhaust gas recycling affects engine wear, a cooperative research program was undertaken by the Department of Engineering, University of California and the Research and Development Center of the Richfield Oil Co. At steady state engine operation, a 90% reduction of piston ring wear was registered when about 12% of the exhaust gas was recirculated back to the inlet manifold. Experiments performed under simulated traffic conditions resulted in a 50% reduction of piston ring wear when 12% of the exhaust gas was recycled. The temperature of the recycled gas did not alter the ring wear reduction effect. However, when condensed water entered the engine inlet manifold, a substantial wear increase of the piston rings was recorded. No adverse effects resulting from exhaust gas recirculation regarding engine deposits and cleanliness were observed. No attempt was made to find more optimal conditions by changing the standard tune-up of the engine with respect to spark timing or air-fuel ratio carburetor settings. (Author conclusions modified)

4619 APTIC NUMBER 14221

Kopita, R. and T. G. Gleason
WET SCRUBBING OF BOILER FLUE GAS. Chem. Eng. Progr., 64(1):74-78, Jan. 1968. 5 refs.

Many new air pollution codes restrict the sulfur content of fuels to 1% and that of fly ash to 0.25 lb/1000 lbs of gas. Wet scrubbers capable of 99% efficiency in particulate removal and 70 to 99% efficiency in SO_2 removal are being constructed from corrosion-resistant stainless steel alloys. Several are designed so that a single unit of equipment can be utilized for particulate removal, absorption, and cooling. Equipment and operating costs depend largely on the complexity of the system, but costs are low compared to those for low sulfur-containing fuel. Representative systems include the following cycles: (1) single-pass liquid cycle, (2) liquid recycle, (3) liquid recycle combined with one-fluid absorption, and (4) two recycle systems combined with two-fluid absorption. The first cycle is designed for the removal of particulate matter, and absorption of SO_2 or nitrogen oxides is incidental. The system is ideally suited to water. To hold makeup water to a minimum, cycle 2 uses a clarifier to reduce the concentration of solids in recycled liquor. Cycle 3 uses chemical absorption with soda ash, salt water, lime slurry, or sodium carbonate. In its simplest version, the scrubbing medium is a weak soda ash solution. The chemical consumption for a 200,000-hr boiler would be approximately 1000 lbs/hr of soda ash. Using both calcium carbonate slurry and soda ash, cycle 3 reduces soda ash consumption to 500 lbs/hr for a 200,000-hr boiler. The $125,000 installation cost of cycle 3 is typical of costs for these systems.

4620 APTIC NUMBER 14283

Lawler, Clayton
AIR POLLUTION CONTROL BY A SULFUR DIOXIDE SCRUBBING SYSTEM. J. Air Pollution Control Assoc., 7(1):29-30, May 1957. (Presented at the Semi-Annual Technical Conference of the Air Pollution Control Assoc., Houston, Texas, Dec. 3-5, 1957.)

A scrubbing system that involves the use of a redwood scrubbing tower and a stripper for recovering the sulfur dioxide from ammonium sulfite-bisulfite solution is described. The scrubbing system was designed to handle sulfur dioxide concentrations as high as 0.9% and considerably higher concentrations for short periods. The system operates at a low temperature of approximately 100 F. Although the scrubbing system is very stable, care is taken to prevent excessive addition of ammonia. Including handling losses, 97% of the ammonia is recovered as ammonium sulfate under normal operating conditions. Since the sulfur dioxide recovery system is provided with automatic controls, little attention from the acid plant operators is required. Virtually all of the sulfur lost by an acid plant can be reclaimed by the use of the scrubber. Research was done in order to reduce the sulfur dioxide to a very low level in the exit stack gases. With a 2-stage Cominco sulfur dioxide recovery system, it is possible to reduce sulfur dioxide concentration in these same gases to less than 0.03% which should be satisfactory to any community.

4621 APTIC NUMBER 14325

Lee, G. and A. C. Coulson
EUROPA 1. THE DESIGN AND DEVELOPMENT OF GAS SCRUBBERS FOR THE EUROPA 1 UPPER STAGES PROPELLANT SYSTEMS. Weapons Research Establishment, Salisbury, S. Australia, Dept. of Supply, TN DWD 22, 65p., Aug. 1968. 24 refs.
CFSTI: N69-27758

The design and development of gas scrubbers for the removal of N_2O_4, unsymmetrical dimethylhydrazine, and Aerozine 50 from nitrogen carrier streams are described. The final scrubber incorporates eight stages fitted with sieve plates made out of an aluminum alloy. At the base of the unit, a stainless steel float valve controls the water outlet flow and maintains a gas-tight seal. The water flow-rate can be set at 0.5 gal/min. In the launcher installation, the umbilical mast vent lines to the fuel and oxidant scrubbers serving the second stage are fitted with nozzle plates at the scrubber inlet flange. These control the gas flow rate. The vent lines from all the other places are fitted with a flowrator and control valve, the arrangement being that manual control can limit the gas flow rate and maintain it while the pressure falls. To allow for imperfect scrubbing of N_2O_4 in the gas streams, the vent gases are led to 45 ft-high stacks situated 750 ft from the installations, and the effluent water is piped to soakage pits located at safe distances from inhabited areas. From the results, it was clear that high efficiencies are obtainable when stripping the fuel gases from an inert stream, but it is not possible at any gas flow rate to remove N_2O_4 down to 5 ppm using this technique. In trying to produce a scrubber system capable of coping with the high impulsive flows, it is probable that the best compromise for a gas scrubber was achieved. The scrubber is best suited to constant flow conditions or to flow conditions which have a limited range of variation.

4622 APTIC NUMBER 14073

Lozhkin, A. F. and N. L. Subocheva
RECOVERY OF NITROGEN OXIDES FROM LOW-CONCENTRATION GASES WITH ACTIVATED CARBON IN A MOVING LAYER. (Ulavlivaniye okislov azota iz nizkokontsentrirovannykh gazov aktivirovannym uglem v podvizhnom sloye). Text in Russian. Sb. Nauchn. Tr. Permsk. Politekhn. Inst., no. 18:61-74, 1965. 14 refs.

The absorbing capacity of grades KAD and AG activated carbon were found to be comparable when used in a stationary or moving layer to absorb nitrogen oxides in low concentration (about 1%). It was found that the higher the state of oxidation of the nitrogen oxides present, the greater the absorbing capacity of the activated carbon. The possibility of determining the linear rate of carbon motion from data on the displacement of a point of constant concentration in a stationary layer is verified. During thermal regeneration, the absorbed nitrogen dioxide dissociates into nitric oxide and oxygen, and there is an accompanying combustion loss of carbon with the formation of CO_2. This carbon loss amounts to about 0.5% of the starting weight for KAD, and 0.4% for AD carbon.

4623 APTIC NUMBER 13970

Lund, Herbert F.
AN EVALUATION OF EUROPEAN INDUSTRIAL AIR POLLUTION CONTROL PRACTICE. Preprint, Air Pollution Control Assoc., 10p., 1968. 5 refs. (Presented at the 61st Annual Meeting of the Air Pollution Control Assoc., St. Paul, Minn., June 23-27, 1968, Paper 68-132.)

The observations and impressions gained from an air and water pollution study tour of western Europe in October 1967 are summarized. On balance, air pollution control practices were judged to be about on a par with those in the United States, with individual plants ranging from excellent to poor. The tour group visited 17 installations in Holland, Denmark, Sweden, Switzerland West Germany, and England, and in addition included inspection of two pollution control research facilities. In general, the countries visited seemed to rely on a combination of various types of public regulations combined with a persuasive approach to bring about industrial pollution control, as opposed to American practice where heavy public pressure prevails. Several installations are singled out for particular comment. The Swiss Cement Manufacturers Association voluntarily established its own very effective emissions standards and enforcement procedures; electrostatic precipitators are the preferred method of dust collection. In Germany, the Ruhr Valley was found to be still be smog-bound, despite claims of year-by-year sulfur dioxide reduction. The plant of Farbenfabriken Bayer AG, a chemical complex in Leverkusen, Germany was judged to be superior to all others visited and to most comparable American plants in its pollution control system. The City of Munich, has overcome some difficult problems and is now using an economically competitive incineration system for its refuse. The waste heat from the incineration process is converted to electric power and hot water for domestic space heating, and the operation has greatly helped the city to develop its suburban communities. It is incidentally noted that an English study of air inversions in 1952 and 1962 led to the conclusion that sulfur dioxide is not injurious to health.

4624 APTIC NUMBER 14118

Markant, H. P.
THE MEAD RECOVERY PROCESS. TAPPI, 43(8):699-702, Aug. 1960. 2 refs. (Presented at the 45th Annual Meeting of the Technical Assoc. of the Pulp and Paper Industry, New York, Feb. 22-25, 1960.)

The Mead neutral sulfite recovery process consists of two basic stages: the total carbonation stage and the sulfiting stage. Green liquor from a storage tank is fed to a precarbonation tower, where it comes in contact with 15% of the total gas in the carbonation tower. When the gas enters the precarbonation tower, it contains H_2S that was released in the carbonation tower. This is reabsorbed by the green liquor, and H_2S-free gas is discharged to the atmosphere. The precarbonated liquor is passed to the carbonation tower, where it absorbs CO_2 and releases H_2S. The gas loses CO_2 and gains H_2S. The next phase of the process takes place in a sulfiting tower. Here the SO_2 in the flue gas from a venturi scrubber cyclone separator is scrubbed with the carbonated liquor. The addition of more contact surface in the absorption system has reduced odors from the process and brought them within acceptable limits. Improvements in the venturi scrubber and the installation of a droplet agglomerator in the sulfiting tower have reduced the amount of particulate matter leaving the process to an extremely low level. The total stack gases are continuously monitored for SO_2 and H_2S, and concentrations are not permitted to exceed 0.03 and 0.01%, respectively.

4625 APTIC NUMBER 14143

Miley, Clare C.
ENGINE SILENCER AND SMOKE ELIMINATION SYSTEM. (Assignee not given.) U. S. Pat. 3,449,907. 3p., June 17, 1969. 5 refs. (Appl. May 18, 1967, 2 claims).

The invention described substantially reduces the amount of smoke and solids discharged from automobile exhausts and smoke stacks. When used on an internal combustion engine, it simultaneously silences engine noise. Smoke is eliminated by cooling hot exhaust gases while they flow through a plurality of small tubes connected to a manifold through which combustion residue is received. When applied to an internal combustion or diesel engine, the invention permits the discharge of oil vapor and other gases from the crankcase through an exhaust line to the tubes. As a result of the increased surface area made available by the tubes, gases are not only cooled, but liquid in the gases is condensed. This liquid serves to further cool the exhaust and to wash out the tubes and pipes through which it flows. In contrast to pressure in a muffler tail pipe, exhaust pressure coming out of the individual tubes is hardly discernible and exhaust noise is almost eliminated. Vertical tubes secured to circular flanges on smoke stacks function in the same way as the tubes cooling automotive exhaust gases, but the number required for any particular installation must be experimentally determined.

4626 APTIC NUMBER 14329

Miller, M. Robert and Donald M. Sowards
SOLVENT FUME ABATEMENT BY CERAMIC HONEYCOMB CATALYST SYSTEMS. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia, Pa., Nov. 1968, p. 321-348. 1 ref.

Previous work demonstrated the functional superiority of ceramic honeycombs as catalyst supports. Heterogeneous catalysis in solvent and hydrocarbon oxidation was studied using direct flame preheating, on both a pilot plant and a commercial scale. Catalyst systems included platinum and palladium, on a variety of catalyst carriers, supported on two different configurations of ceramic honeycomb. The easily oxidized solvents were found to exhibit similar oxidation behavior. Precious metal catalyst behavior was found to be relatively independent of metal concentration, carrier composition, and surface area. Carbon monoxide and aldehydes, as well as other intermediate oxidation products are generated in the direct flame preheater. A major portion of each of these was oxidized to carbon dioxide and water in the catalyst bed. Pilot plant catalyst volume was scaled-up by a factor of 450 to a commercial size, with good correlation of basic performance characteristics. It is expected that the extensive small-scale investigations can provide a sound basis for the design and operation of catalytic oxidation systems for air pollution control. It is concluded that the type of catalytically active component and the geometric features of the support are major factors in catalyst efficiency.

4627 APTIC NUMBER 14266

Miner, Samuel S.
DEVELOPMENTS IN AUTOMOTIVE STEAM POWERPLANTS. Preprint, Society of Automotive Engineers, Inc., New York, 9p., 1969. 15 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690043.)

Lower pollutant emission characteristics of external combustion engines, compared to internal combustion engines, have brought renewed interest in the use of steam power for automobiles. A brief review of steam car development in the last 70 years is presented, with descriptions of the technical characteristics of five of the more than 125 models of steam car that have been either produced or proposed between 1895 and the present. These are the Stanley, produced from 1897-1899 and 1903 to 1925; the White, 1901 to 1910; the Doble, 1910 to 1934; the Paxton-Phoenix, 1954; and the Williams, now in production. Where the data are available, comparisons among these cars are made in terms of fuel rates and water rates. It is concluded that at the present time, the actual operating efficiencies of automotive steam powerplants and internal combustion powerplants are relatively close, thus shifting emphasis in making a choice between the two to such properties as relative pollutant emission levels, noise levels, torque-speed relationships, or multifuel capability, in which steam engines may have definite advantages.

4628 APTIC NUMBER 12640

Anon.
AIR QUALITY AND ASARCO. Mining Congr. J., 54(11):26-29, Nov. 1968.

Formal research into air quality was undertaken by American Smelting and Refining Co. as early as 1914. Since then they have applied their results and the findings of others to the protection of their employees and their communities. Some of the equipment being used is described briefly.##

4629 APTIC NUMBER 14262

Napier, D. H. and H. H. Stone
CATALYTIC OXIDATION OF SULPHUR DIOXIDE AT LOW CONCENTRATIONS. J. Appl. Chem., vol. 8:781-786, Dec. 1958. 8 refs.

A suggested process for removing sulfur dioxide from boiler flue gases requires as a first stage the oxidation of sulfur dioxide to sulfur trioxide, followed by the removal of sulfur trioxide as ammonium sulfate or sulfuric acid. The first stage of the process was investigated by passing a synthetic flue gas mixture, with a sulfur dioxide content between 0.13 and 0.17%, through a fixed bed of vanadium catalyst containing by weight 6.7% V205 and 7.5% K20. Results confirm that water vapor and carbon monoxide in the gases have no adverse affect on the catalyst and that the required contact time at low sulfur dioxide concentrations is much lower than that used in the contact process. Equilibrium was obtained for contact times of 0.09 to 0.43 sec. Fractional conversions obtained were close to the equilibrium value of sulfur dioxide concentrations and not dependent on oxygen concentrations. However, the values of the fractional conversion are reproducible to only plus or minus 4%, and the sulfur dioxide concentrations to plus or minus 10%.

4630 APTIC NUMBER 13990

Nicklin, T.
THE STRETFROD METHOD FOR REMOVAL OF SULFUR FROM GASES. (Das Stretford- Verfahren zur Entfernung von Schwefel aus Gasen). Text in German. Brennstoff-Chem (Essen), 50(4):T24-T25, April 1969.

Recent developments of the Stretford process are reported. This method was originally developed for cleaning of coke oven gas but has also been found to be suitable for elimination of hydrogen sulfide from any kind of gas mixtures at standard or elevated pressures. Additions of sodium vanadate to the scrubber solution have resulted in appreciably shorter reaction times.

4631 APTIC NUMBER 14196

Peters, H. S.
CAUSES, IMPORTANCE AND CONTROL OF NITROGEN/OXYGEN COMPOUNDS IN THE FIELD OF AIR POLLUTION. (Ursachen, Bedeutung und Kontrolle der Stickstoff/Sauerstoff-Verbindungen in der Luftverunreinigung). Text in German. Chem. Ing. Tech., 41(10):593-644, May 1969. 13 refs.

In heavy smog, nitrogen oxide concentrations of 1 to 3 ppm have been measured over some cities. Physiological effects on humans have been observed at 3 ppm and 8 hours of exposure. The nitrogen oxides in the atmosphere come mostly from motor vehicles and power plants, as well as from chemical plants, such as nitric acid production plants, plants for the recovery of catalysts, pickling plants, etc. In the gasoline powered engine, a high nitric oxide concentration is formed at ignition temperature (2200 C). Since the gases cool rapidly to ambient temperatures, no equilibrium conditions can be attained and the nitric oxide concentration of exhaust gas is rather high. There are two possible methods of avoiding this. The ignition temperature should be lowered or the gas should be cooled at a slower rate. Otherwise, a catalyst should be found which speeds decomposition of nitrogen oxides at low temperatures. There are also several methods for reduction of nitrogen oxides from stack gases. Adsorption on zeolites and certain other types of molecular sieves is a rather promising method. Intense research on these methods is recommended, since little is known about them.

4632 APTIC NUMBER 14137

Pollock, W. A., J. P. Tomany, and Garry Frieling
FLUE-GAS SCRUBBER. Mech. Eng., 89(10):21-25, Aug. 1967.

Results are given of tests on the Turbulent Contact Absorber, a wet scrubber for removing sulfur dioxide from the flue gas of central power stations, that is designed and manufactured by Universal Oil Products Co. This scrubber utilizes turbulent motion of mobile packing to maintain high mass-transfer rates and efficient particulate collection over a fairly wide range of flows with low pressure drop, all in the presence of reasonably dense, low pH slurry and at high gas velocities. It was concluded after testing that a system comprised of direct limestone injection into the furnace in combination with wet scrubbing is practical for the simultaneous removal of fly ash and sulfur dioxide from coal-burning power-plant flue gases. Fly-ash collection efficiencies on the order of 98% and overall sulfur dioxide removal of 91% can be expected with the system at wet scrubber pressure drops of about 4.5 in. wg. For a generating capacity of 25 MW equivalent to 100,000 cfm of flue gases at 300 F, the investment and operating costs as of 1967 are about $10 per kw and $1.17 per ton of coal.

4633 APTIC NUMBER 14051

Rabson, S. R.
THE DEVELOPMENT OF A WET SCRUBBER FOR USE AT CRUSHING PLANTS AND THE LIKE. J. Mine Ventilation Soc. S. Africa, 21(1):1-10, Jan. 1968.

The 'whirl' scrubber described is considered to fill the needs of the mining industry for a low-cost scrubber capable of collecting the dust produced during crushing and grinding operations. It also has applications for the processing of manganese and lime in uranium plant operations. The action of the whirl scrubber depends on agglomeration of the dust particles with atomized spray particles, and this is achieved by spinning the dust-laden air through a set of whirler or spinner blades. The severe differential velocities created, as a result of inertial effects, between solid and liquid particles are found to promote successful agglomeration. The agglomerated particles are subsequently separated from the air stream by a cyclone separator in which cyclonic motion is imparted to the air by blades similar to those used in agglomeration. Collection efficiency of the scrubber is about 96% by weight on crushing dust, and can be increased by use of a two-stage or three-stage agglomerator. The pressure drop across the unit is about 2 in. wg, while water consumption is about 1 gpm/1000 cfm.

4634 APTIC NUMBER 14212

Weidel, John C.
AIR-POLLUTION CONTROL IN HOUSTON AREA. Oil Gas J., 54(18):107-109, Sept. 5, 1955. 3 refs.

A 30-ton-per-day sulfur recovery plant to prevent release of hydrogen sulfide to the atmosphere is described. The design features are operator control of amine feed to the amine stripper located at the sulfur recovery unit, release of hydrocarbon vapors from the stripper to the refinery flare, reactors and scrubber sections combined in one column, and instrumentation features allowing the plant to be operated by one man. The basic principle of the sulfur recovery process is summarized as follows: $3H_2S$ plus $3O_2$ yields $2SO_2$ plus $2H_2O$; $2H_2S$ plus SO_2 yields xS_2 plus yS_6 plus zS_8 plus $2H_2O$. In the final step, sulfur vapor is condensed and collected as liquid sulfur. Hydrogen sulfide recovery and the function of the amine stripper are discussed. Diagrams of the H_2S and sulfur recovery processes are presented.

4635 APTIC NUMBER 14165

Rightmire, R. A., J. W. Sprague, W. N. Sorensen, T. H. Hacha, and J. E. Metcalfe
A SEALED LITHIUM-CHLORIDE FUSED SALT SECONDARY BATTERY. Preprint, Society of Automotive Engineers, Inc., New York, 8p., 1969. 5 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690206.)

A sealed, secondary fused salt battery was developed which has promise as a battery for electric automobiles. The battery uses active carbon plate cathodes, solid aluminum-lithium alloy anodes, and a fused lithium chloride-potassium chloride electrolyte. Cathode capacity is enhanced by the chemisorption of electrochemically active additives onto the carbon surface. The battery operates between 662 and 932 F. The best energy density yet achieved on a cell is 37.6 w-hrs/lb. An improved carbon cathode being developed should enable an energy density of 70 w-hrs/lb to be achieved. Insulation bus bars and internal heating coils are expected to add 15% to the weight of the battery. A five-cell battery of sub-optimum design operated satisfactorily for short cycles. Parasitic leakage currents of less than 0.3% energy loss per hour was demonstrated. Cycle life of over 1000 cycles was attained on the electrodes. This particular battery is characterized by simplicity in fabrication and low-cost materials. This should enable a low-cost battery to be developed which will be the key to any significant use in electric automobiles. High-temperature operation, while a disadvantage, does not seem to present insurmountable barriers to the use of fused salt batteries. Superinsulations now available permit extensive off periods without solidification of the electrolyte. It was concluded that the simple plate electrode approach offers the best chance for an ultimate high-energy density, long-life, low-cost battery which would be required before electric automobiles and other electric vehicles become practical for general use.

4636 APTIC NUMBER 14296

Rivers, Richard D. and Jimmie D. York, Jr.
GAS FILTER MOUNTING STRUCTURE. (American Air Filter Co., Inc., Louisville, Ky.) U. S. Pat. 3,460,322. 3p., Aug. 12, 1969. 11 refs. (Appl. Oct. 5, 1967, 2 claims).

The present invention pertains to an improved apparatus for gas separation with a minimum of leakage. It provides an improved gas filter structure for fastening filter cell and interposed gasket in sealed engagement with a support frame. The mounting arrangement is straightforward and economical in construction and maintenance, allowing quick installation and removal of a filter cell unit, permitting accurate alignment of support superstructure, and requiring a minimum application of edge sealant materials. The filter is obtained by mounting a filter cell so that its rim is sealed in relation to a flowthrough support frame. The mounted housing of the filter cell includes a side wall surrounding a flowthrough passage of the support frame face wall and a smooth peripheral face wall, uninterrupted by any breaks or welds, surrounding a second flowthrough passage. To receive the filter cell and interposed gasket in flush sealing engagement, this wall is aligned with the first flowthrough passage. Flanges attached to this wall are mounted to the support frame face wall. Means to fasten the flanges include numerous spaced apertures adjacent to the support frame's first flowthrough passage. These apertures are aligned with bolts whose heads are welded to the flanges.

4637 APTIC NUMBER 14070

Poemmer, Gerhard
THE SULFIDIN METHOD, A NEW MEANS OF UTILIZATION OF GASES CONTAINING SULFUR DIOXIDE. (Das Sulfidin-Verfahren - ein neuer Weg zur Nutzbarmachung schwefeldioxydhaltiger Gase). Text in German. Metall u. Erz, 34(1):5-11, 1937. 12 refs.

An inexpensive process is described for the regeneration of SO2 at 80 deg or above in roasting gases containing up to 100% SO2. Gases are washed with a mixture of water and aromatic amines, either raw toluidine or xylidine. The method is based on the ability of the aromatic amines to form loosely held compounds with SO2. The amount of absorbed SO2 oxidized to SO3 is slight. If desired, the regenerated SO2 can be reduced to sulfur with coke. The sulfur obtained is 99.995% pure and free from As, Se, and bitumens.

4638 APTIC NUMBER 14025

Ryason, P. R. and J. Harkins
STUDIES ON A NEW METHOD OF SIMULTANEOUSLY REMOVING SULFUR DIOXIDE AND OXIDES OF NITROGEN FROM COMBUSTION GASES. J. Air Pollution Control Assoc., 17(12):796-799, Dec. 1967. 13 refs.

In this study, a high-sulfur fuel was used and SO2 concentrations were measured ahead of and following the catalyst bed to test the simultaneous reduction of SO2 and NO. Synthetic gas mixtures of SO2 in N2 and CO plus CO2 in N2 were combined in various proportions as the reactant gases. A number of different metals, supported on an alumina extrudate or on a silica gel, were tested for the reduction of SO2. The test gas contained twice the stoichiometric amount of CO. Tests for SO3 in the offgases were negative, as expected in a reducing atmosphere. The COS concentration depended on the composition of the reaction gas mixture. Generally the mixtures stoichiometric in CO showed somewhat less reduction than did the mixtures containing a twofold excess of CO. Reactant gas mixtures containing excess CO deposited sulfur in the cooler parts of the apparatus downstream from the catalyst bed, but this amount was negligible. To utilize the reduction reactions in a practical system at relatively high dilutions requires a catalyst, the most active being copper supported on alumina. Substantial reduction (90% or greater) can be achieved in 0.35 sec, corresponding to a space rate of 10,000 vol/vol/hr. A side reaction of carbon monoxide with elemental sulfur to form COS requires that the initial amount of CO be stoichiometric for the amount of SO2 plus the NO present. To employ this method for the purification of flue gases would require near stoichiometric fuel air operation of the furnace. Thermodynamic considerations show that the optimum initial ratio of CO to SO2 is somewhat less than 2 to minimize the production of carbonyl sulfide. Substantial reduction of undesirable sulfur compounds and essentially quantitative reduction of oxides of nitrogen are possible with this method.

4639 APTIC NUMBER 14193

Saito, Takeshi
AUTOMOBILE EMISSION AND MOTOR OILS. (Dorogai soko sharyo ni saiteki no sekyu tenka zai). Text in Japanese. Junkatsu (J. Japan Soc. Lubrication Engrs.), 14(2):61-69, 1969. 11 refs.

Exhaust gas, blowby gas, and carburetor vapors constitute automotive emissions. A Positive Crankcase Ventilator (PCV) recycles carbon monoxide- and hydrocarbon-containing blowby gas from the crankcase to the cylinder. A 'road draft system' results when there is no recycle. A high grade motor oil, e.g., 'long life', is necessary to prevent the PCV tube from becoming filled with sludge and the PCV bulb should be a 'zigle' pin type. The motor oil test is discussed at length and the sludge characteristics of a new oil are evaluated on the basis of its total alkali number.

4640 APTIC NUMBER 14162

Saltsman, R. D.

FACING UP TO THE SULFUR CONTENT OF COAL. Preprint, American

Society of Mechanical Engineers, New York, United Engineering Center, 8p., 1969. (Presented at the Industrial Fuels Conference of the ASME, St. Louis, Mo., Feb. 11-13, 1969.)

The industrial and commercial users of coal must rely primarily on low-sulfur coal for some time to come. To ensure an adequate supply of this naturally occurring or pre-processed low-sulfur coal, it will be necessary to develop efficient air pollution control devices for the electric utilities. The use of dry additives, such as dolomite and limestone, could provide the industrial user of coal with a means for complying with air pollution control ordinances which require reduction of SO_2 emission by 30 to 40%. Chemical processing with a central product recovery and reagent regeneration plant would offer the industrial user an efficient air pollution control process that would allow the use of a relatively high-sulfur coal. Other methods of reducing SO_2 emission, such as wet scrubbing and catalytic oxidation, are also discussed.

4641 APTIC NUMBER 14094

Shah, I. S.
NEW FLUE-GAS SCRUBBING SYSTEM REDUCES AIR POLLUTION. Chem. Eng., 1967:84-86, March 27, 1967.

Chemico's new two-stage scrubbing system enables pulp mills to greatly improve overall dust collection efficiency and to meet stricter air pollution regulations. Flue gases from the recovery boiler enter the two-stage system, which consists of evaporator, scrubber, separator, and cooling tower, and are vented to the stack 99% cleaner and 500-600 F cooler. Concentrated black liquor is further concentrated to 60-70% solids content by direct contact with flue gases in the Venturi evaporator. With about 40 in. H_2O static pressure for the system, the outlet dust leading can be reduced to 1 lb/ton of pulp. The two-stage system provides greater heat recovery because it exhausts stack gases at temperatures below 120 F, as compared to 325 F from electrostatic precipitators, and 180-190 F from single-stage scrubbing systems. Chemico has also perfected two oxidation systems for black liquor that reduce the amount of H_2S emitted to atmosphere. One is for weak black liquor and the other for strong black liquor.

4642 APTIC NUMBER 14274

Shreve, W. B., G. B. Pelleu, Jr., and L. W. Wachtel
EFFECT ON AIRBORNE BACTERIA OF EXTRANEOUS PARTICULATE MATTER OR AIR FILTRATION. National Naval Medical Center, Bethesda, Md., Naval Dental School, Work Unit MR.005.19-6050, NDS-TR-007, 7p., Jan. 7, 1969. 8 refs.
DDC: AD 684101

Dissemination of microorganism-bearing aerosols in dental operatories has raised questions about potential risks of airborne infection, since the use of high-speed rotary and ultrasonic instruments, with their air and water coolant sprays, has increased both the production of aerosols and their microbial concentrations. A study was made of methods to reduce such concentrations. The influence of particulate matter on airborne bacteria and the effectiveness of an 800 cfm high-efficiency particulate air(HEPA) filter unit in reducing airborne bacteria were measured. A room approximately 700 cu ft in size was constructed of plastic material, and was kept sealed except for an intake of dust-free, bacteria-free air. The fallout rate of Bacillus subtilis spores was determined in a dust-free environment and also in the presence of known amounts of airborne particulate matter: 3.0 to 15.0 gm of $Ca_3(PO_4)_2$ powder, or 0.3 or 1.0 gm of hair spray. The fallout rate of the spores (32% per hour) was found to increase with the addition of either form of particulate matter, resulting in a maximum two-fold increase with 5 gm of powder, and a 1.6-fold increase with 1 gm of spray. The HEPA filter unit was effective in reducing peak concentrations of airborne bacteria by 35%, and in clearing the room of all airborne spores in 8-10 min. Although the unit should be tested in larger rooms, its effectiveness in the present tests was so high that it is anticipated that it can be used in rooms as large as 2000 cu ft. (Author abstract modified)

4643 APTIC NUMBER 14176

Siegmund, C. W.
LOW SULFUR INDUSTRIAL FUEL OILS. Preprint, American Society of Mechanical Engineers, New York, United Engineering Center, 8p., 1969. 3 refs. (Presented at the Industrial Fuels Conference of the ASME, St. Louis, Mo., Feb. 11-13, 1969, Paper 69-FU-2.)

The general effect of air quality regulations, which limit fuel oil sulfur content will be a trend toward better fuel oils which will give fewer operating problems. The types of changes which occur will be similar whether the fuels are made from natural low-sulfur crude or by desulfurization. The fuels will be lower in viscosity and ash content and will tend to form fewer stack solids. The problems caused by SO_3, cold end corrosion, and acid smut formation will be eased, but good combustion control will be required. It is expected that these fuels will be more expensive than current fuels due to processing costs or the cost of transporting fuel to an area not normally tributary to the source. However, the increased fuel costs may be compensated for by decreased operating costs as a result of improved fuel quality. In some situations, meeting air pollution regulations will be accomplished more economically by desulfurizing the flue gas; where flue gas desulfurization is used, the highest sulfur fuel will result in the lowest net cost.

4644 APTIC NUMBER 14161

Singhal, R. K.
FUME CLEANING SYSTEMS USED IN THE STEEL INDUSTRY. PART 2. Steel Times (London), 197(9):605-613, Sept. 1969.

A number of wet and dry fabric filters and mechanical cleaners are described and applications are mentioned. In the fabric dust collectors, the dust-laden gas is passed through a semi-porous medium which retains the dust particles and allows the clean gas to pass through. Efficiency is very high and the two main types in use are the mechanical vibration type and the reverse flow type. Fabric filters are widely used in the metallurgical industry and in electric arc furnace fume cleaning. Wet dust removers possess a number of advantages over the cyclone and fabric filter in cases where humidity or space requirements preclude their use. The removal of collected dust presents no problem; it is in the form of sludge or slurry. This is essential with explosive dusts such as magnesium alloys and aluminum. The Medusa gas scrubber consists of a three-fold combination of impingement, venturi and disintegration effects. Alteration to the liquid level provides flexibility for changes in gas volume and efficiency. The Elbair gas scrubber is noted for its high efficiency, low pressure loss, low hp requirements, and compactness. The Tornado Flow Dust collector simulates the flow patterns of a natural tornado by setting up two rotational flows with opposite axial components, occupies a small space and can be fitted into a chimney or can be arranged horizontally in pipelines. The Western Precipitation high-energy venturi scrubber was designed for gas cleaning operations requiring high pressure drops. Its primary applications are for blast furnaces, cupolas, oxygen converters, open hearth, and electric furnaces, and oxygen deseamers. The American Air Filter Type R Roto-clone is a wet centrifugal dust collector. The main component is a series of specially designed double-inlet tubes. In the Pangborn Type CH-3 dust control system, the air is drawn from the dust-producing source by means of ducts to the collector. The self-cleaning collector operates continuously and requires no periodic exhauster shutdown for cloth cleaning.

4645 APTIC NUMBER 14068

Spengler, Guenter
DEVELOPMENT OF METHODS OF PURIFICATION OF SULFUR OXIDES FORMED BY THE USE OF SULFUR-RICH COAL AND FUEL OIL. (Die Entwicklung der Reinigungsverfahren fuer Schwefeloxide bei Verwendung schwefelreicher Kohlen und Heizoele). Text in German. Staub (Duesseldorf), 23(3):171-175, March 1963. 22 refs.

The underlying chemical reactions and existing or potential industrial implementation of published methods for reduction or elimination of emissions of sulfur oxides into atmospheric air are critically reviewed. Desulfurization of coal is technically possible, but at present it is uneconomical; that of liquid fuel oils ranges from technically impossible for heavy grades to possible and economical for the light grades; desulfurization of gaseous fuels is both possible and economical. Additives for elimination of sulfur oxides during fuel combustion are still in an experimental stage. Solid fuel gasification followed by gas desulfurization is being successfully used in city gas plants. Dilution of flue gas by the use of high smoke stacks is satisfactory only under very special atmospheric conditions. Cleaning of flue gas for partial or complete elimination of sulfur oxides may be combined with removal of other pollutants, such as dust, soot, condensed heavy hydrocarbons, hydrogen fluoride, etc. Among wet cleaning processes for absorption of sulfur oxides, the author describes in detail the 'Cominco' process, the Fulham-Simon-Carves process, the limestone process of the Essener Steinkohlenbergwerke, the B.E.A. process of Battersea Electric, the Howden-I.C.I. process, and the Johnstone-Singh process. In discussing the dry cleaning processes for absorption of sulfur oxides, the author refers to the experimental program of the U. S. Bureau of Mines. The Johswich-Strataann Clean-Air process is a dry cleaning process in which sulfur oxides are adsorbed by activated charcoal. It is concluded that the flue gas cleaning methods show the greatest promise of attaining the goal of economical elimination of sulfur oxide emissions.

4646 APTIC NUMBER 14207

Squires, Arthur M.
AIR POLLUTION: THE CONTROL OF SO2 FROM POWER STACKS. PART II. THE REMOVAL OF SO2 FROM STACK GASES. Chem. Eng., 74(24):133-140, Nov. 20, 1967. 34 refs.

By adding finely divided MgO to residual oil and operating with little excess air, a power company was successful in controlling SO3 emission. A pilot electrostatic precipitator was tested working at temperatures that could effectively reduce the opacity of a plume from an oil-fired station. Injecting raw dolomite or limestone into furnaces provides an easy means of eliminating SO2 from the stacks of power stations. Another company reported pilot plant operations in which a stoichiometric amount of raw dolomite was injected into a boiler, and a slipstream of flue gas was treated in a pilot scrubber. More than 90% of the SO2 was removed. In Wisconsin, a company which had not used a scrubber in operations where a stoichiometric amount of raw limestone was injected, reported data to support the contention that a system using limestone could remove more than 80% of the SO2. Methods of recovering stack-gas sulfur, such as reduction with methane, are also discussed.

4647 APTIC NUMBER 14290

Staubing, Peter
GERM SEPARATION WITH AIR FILTERS. (Keimabscheidung mit Luftfiltern). Text in German. Wasser, Luft Betrieb, 13(2):42-45, Feb. 1969.

Measurements of the atmosphere above streets showed that it contains from 1000 to 10,000 germs/cu m. In closed rooms or in dense residential areas, the concentration may be higher. Most of the germs in the air are harmless and deteriorate rapidly through dehydration. Although there are just a few pathogenic germs, their further development might be spurred by these numerous harmless germs. Most germs range in size from 10 to 150 micrometers and cause no direct problems with respect to filtration from the air. However, there are some smaller than 0.1 micrometers, and collection of them is somewhat more problematical. Usually, they cling to dust particles and can thus be retained by air filters. Metallic air filters wetted with a bactericidal agent are no longer in use, since their collection efficiency is limited to certain grain size; dust particles of 10 micrometers and less can pass the through filter. Various types of fiber filters can be used for this purpose, but these filter media cannot be regenerated and must be replaced. For economic operation of these fiber filters, preliminary separation of coarse particles is recommended.

So-called suspended particle filters attain high collection efficiencies with dust particles of less than 1 micrometer. They are frequently used as the final stage in multi-filter arrangements. Various methods to test the efficiency of these filters exist, e.g., with oil mist (0.3 to 0.5 micrometers), radioactive aerosols (less than 0.3 micrometers), and quartz dust (0.5 and 2 micrometers). Electrostatic precipitators may likewise be efficiently used for this purpose.

4648 APTIC NUMBER 13991

Staubing, Peter
THEORY OF DUST SEPARATION IN THE FILTER MEDIUM. (Zur Theorie der Staubabscheidung im Filtermedium). Text in German. Wasser, Luft Betrieb, 13(4):122-124, April 1969.

A detailed discussion is presented on mechanical air filters for dust separation, with either metal or fiber baffles, and on the effects of dust grain size, inertia, and diffusion of dust particles, and viscosity on dust-retaining baffle coatings.

4649 APTIC NUMBER 14315

Sutotskii, G. P., S. E. Kodes, A. V. Parvov, M. A. Petukhov, and L. I. Shtivel'
CHEMICAL PROCESSES IN THE WATER OF RECIRCULATION SYSTEMS OF WATER SUPPLY FOR THE WET CLEANING OF GASES. Steel (USSR) (English Transl from Russian of Stal), no. 5:519-523, May 1969. 14 refs.

A general analysis is presented of the mechanism of the physico-chemical processes involved in the recirculation cycle of recirculation-type water supply systems of gas cleaning plants associated with blast furnaces, ferroalloy furnaces, and converters. Chemical reactions and changes in pH of the recirculated water of waste gas cleaning installations are considered in connection with the risks of corrosion or scale formation in the plant. Ways of avoiding these risks are analyzed mathematically. In general, the value of the recirculating water alkalinity should not be lower than 1 mg-equiv/l and the alkalinity of the recirculating water from carbonate deposits should not exceed 2-3 mg-equiv/l. These corrections should be introduced into existing standard design data. In the case of cyclic metallurgical furnaces in which oxygen is used, it is necessary to install means for averaging out the contaminants. These means would also act as deactivators for the slurry. The use of such deactivators frequently makes it possible to increase the loading of the radial settlers or to replace the latter by pressureless cyclones. Because of the complication and expense of chemical treatment methods in stabilizing the quality of the recirculated water in closed water supply systems, wider use should be made of the recommended measures and modifications of the gas cleaning process.

4650 APTIC NUMBER 14036

Taylor, R. E. and R. M. Campau
THE IIEC - A COOPERATIVE RESEARCH PROGRAM FOR AUTOMOTIVE EMISSION CONTROL. Proc. Am. Petrol. Inst., Sect. III, vol. 49:309-327, 1969. 5 refs.

The Inter-Industry Emission Control Program, which now is comprised of six petroleum companies and five automobile manufacturers (including four foreign firms), was established in 1967 and expanded in 1968 to pool the research efforts of the two industries in the design and development of a virtually emission free, gasoline-powered vehicle. Specific targets call for a 90 to 97% reduction in the hydrocarbon, carbon monoxide, and nitrogen oxide emissions of a typical vehicle and are aimed at improving the quality of the Los Angeles Basin, considered the most critical air shed area in the United States. Of some 17 research projects begun under the program, those associated with catalysts, thermal reactors, exhaust gas recirculation, and modification of fuel properties are receiving the major current attention, using techniques ranging from mathematical modeling to component hardware development and testing, to the building and testing of complete concept cars, which combine various emission control sub-systems into fully-functioning automobiles for total emission evaluation, durability testing, and product acceptability evaluation. Descriptions of the various research problems and methods are given. Because of Federal emissions testing requirements, much of the total effort is directed toward designing exhaust control systems that can operate at high efficiency almost from the moment of engine start-up. Summaries are given of the investigations underway that deal with the fuel and hardware components of a spark ignition engine; these involve the development of additives to suppress nitrogen oxide formation, hydrocarbon combustion-improving additives, hydrocarbon deposit-modifying additives, surface tension and emulsifying agents, and the study of the effect of fuel volatility on exhaust and evaporative emissions.

4651 APTIC NUMBER 14159

Thomas, Fred W.
TVA'S AIR QUALITY MANAGEMENT PROGRAM. Proc. Am. Soc. Civil Engrs., J. Power Div., Paper 6483:131-143, March 1969. 18 refs.

The air quality program of the Tennessee Valley Authority as related to its fertilizer and coal- and nuclear-fired power plants is reviewed. Preventive aspects of pollution control are basic to the program designed for steam-electric generating plants. Plants are located at sites where terrain is favorable to effective dispersion, and air quality measurements are recognized in planning and designing plant structures. The program is supplemented by an extensive monitoring system for measuring sulfur dioxide, fly ash, ozone, and nitrogen oxide emissions. Mobile sampling equipment is used in conjunction with stationary monitoring systems because it appreciably shortens the period required to define air quality in the vicinity of a plant. TVA also conducts extensive research studies on plume dispersion, levels of ground level fumigation during inversion breakup, and chemical processes for the removal of SO2 from flue gas. At nuclear plants, an extensive network of instruments monitors airborne particulates, radioiodine, heavy particulate fallout, and rainwater. TVA has sought to prevent deleterious effects from SO2 emissions primarily through the use of high stacks designed to limit SO2 concentrations at ground level. As unit size and plant capacity increase, stack heights are being raised from 170 to 800 to 1000 ft. With increasing worldwide attention focused on techniques for converting SO2 to sulfuric acid or fertilizer, TVA is now exploring the use of limestone in pulverized coal-fired units and cyclone-furnace units. Where fly ash creates a nuisance problem, TVA is substituting 95% efficiency precipitators for mechanical collectors.

4652 APTIC NUMBER 14178

Tucker, L. M.
SULFUR OXIDE STACK EMISSIONS - REACTIONS AND CONTROL. Proc. Am. Petrol. Inst., Sect. III, vol. 49:615-650, 1969. 11 refs.

Four processes for removing at least 90% of the sulfur oxides from flue gases were evaluated and found to be technically feasible. The engineering study covered both coal- and oil-fired 800 MW power plants with emphasis on the latter. Operating costs of $0.40 (1968) and less per barrel of heavy fuel oil were possible. It was concluded that processes are available giving a choice of sulfur by-products or no saleable product at all. Only the dolomite process is likely to be installed readily in an existing plant and this would not be attractive if the plant already has an efficient precipitator. The other three processes are feasible in new installations where space requirements for reactors and precipitators can be met. Two of the processes require precipitators on hot flue gases because the reactors for removing SO2 require high temperatures and would otherwise be quickly plugged or deactivated. In an oil-fired plant, perhaps only the Monsanto process would require a precipitator previous to SO2 removal. The operating costs of the Monsanto and Reinluft processes vary considerably with the amount of sulfur present in the fuel and value of the by-product. When the price of sulfur is high, operating costs are minimized and may disappear completely if high-sulfur fuel is utilized. On the other hand, the operating costs of the dolomite process become greater as the sulfur content of the fuel increases. A separate investigation is studying the reactions of sulfur dioxide after it leaves the stack. A laboratory pilot plant and radiation chamber have been constructed to reproduce power plant emissions and to follow SO2 decay under controlled synthetic atmospheric conditions.

4653 APTIC NUMBER 14061

Velzy, C. O.
THE ENIGMA OF INCINERATOR DESIGN. New York, American Society of Mechanical Engineers, New York, 1968, 8p. 17 refs. (Presented at the ASME Winter Annual Meeting and Energy Systems Exposition, New York, Dec. 1-5, 1968.)

Until recently, municipal incinerators were largely empirically designed. The increasing emphasis on prevention of pollution of the environment, together with rapidly changing refuse constituents and characteristics, is forcing a change in these previously accepted design approaches. To select the air pollution control equipment best suited to a particular problem, concise information as to the nature, characteristics, and magnitude of the problem is required. The more rigid present-day air pollution codes will require the application of more sophisticated abatement equipment. Such equipment includes medium-to high-energy wet scrubbers and electrostatic precipitators. With refractory furnaces, the gases must be cooled prior to being discharged to the air pollution control equipment. This is accomplished by adding spray water to the gas stream. A portion of the gaseous pollutants discharged from the furnace would be removed by this cooling water. Much more data must be collected from presently operating incinerators and properly correlated with furnace type, furnace configuration, operating variables, and refuse composition.

4654 APTIC NUMBER 14190

Warren, Glenn B. and John W. Bjerklie
PROPOSED RECIPROCATING INTERNAL COMBUSTION ENGINE WITH CONSTANT PRESSURE COMBUSTION. COMBUSTION CHAMBER SEPARATED FROM CYLINDERS (MODIFIED BRAYTON CYCLE). Preprint, Society of Automotive Engineers Inc., New York, 20p., 1969. 8 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690045.)

A reciprocating engine with gas turbine-type combustion at nearly constant pressure is proposed for automotive application after an extensive design and computer analysis. Basically, the proposed cycle is the classic 'Brayton' or open gas turbine cycle applied to a reciprocating compressor and reciprocating hot gas engine. In the Brayton cycle, combustion takes place continuously at constant or nearly constant pressure in a chamber between the compressor and the engine or turbine. The high compression ratio and the higher maximum temperature permitted by this arrangement makes the cycle relatively efficient despite some losses and without the necessity of regeneration, as on the gas turbine, to obtain comparable efficiencies. Although the basic idea of such an engine is over 50 years old, it received little development until recent technological innovations, as well as increased pressures to control automotive emissions, directed attention to its potential advantages. The 'flame-quenching' phenomenon in present engines which produces unburned hydrocarbons will be eliminated in the proposed engine because the combustion, having an inherently leaner mixture, will have been completed before the quenching takes place on the colder walls of the expansion cylinder. It is believed that the operation of the proposed engine will almost completely eliminate other undesirable exhaust elements, reduce fuel consumption 20-30%, and permit the use of less expensive fuels. Details and technical data are presented on the design and computer investigation of this cycle, with extensive descriptions given of the engine, the combustion system, exhaust gas composition, still-unsolved problems, and probable operating results. Part II presents and analyzes data comparing automotive emissions between various types of engines via the 'adjusted-to-stoichiometric' method. (Author abstract modified)

4655 APTIC NUMBER 14028

FILTRATION OF WASTE AIR FROM DRY CLEANING MACHINES. (Filterung der Abluft aus Reinigungsmachinen). Text in German. Wasser Luft Betrieb, 13(4):127-128, April 1969.

The fifth regulation of the Law for the Prevention of Air Pollution in North Rhine-Westphalia of 1967 is now in effect. It concerns all machines for cleaning and drying textiles, leather goods, or furs if they operate with chlorinated hydrocarbons in the form of trichloroethylene or perchloroethylene. The regulations pertain to all sizes of machines so that tumble driers and coin-operated cleaners are also affected. In a departure from other regulations, a specific method for cleaning of the waste air is required, namely, filtration with activated coal. The concentration limit cannot exceed 200 mg of solvent per cu m waste air. Commercially available activated coal is capable of storing 25 to 35% more solvent than must be regenerated. For this reason, installation of two filters is recommended. The efficiency of a charcoal filter is rather high, so lower concentrations than the prescribed limit concentration are obtained. Since the odor threshold of trichloroethylene fluctuates between 260 and 520 mg/cu m and that of perchloroethylene is 360 mg/cu m, the effectiveness of the filter can be roughly evaluated by the presence or absence of odor at the filter outlet. According to the regulations, official inspections will be made once a year without charge. For this purpose, the Draeger trace gas-measuring unit will be used. The solvent retained by the activated coal can be recovered and returned to the process. Investment costs should be amortized within two years.

4656 APTIC NUMBER 14141

Wiedemann, C. R.
A DISCUSSION OF SOME CUPOLA DUST COLLECTION SYSTEMS. PART II.
Mod. Castings, 56(4):66-68, Oct. 1969.

The mechanics of cupola dust collecting systems are summarized and their operating efficiencies are compared. By their ability to remove dust particles 50 microns in size and larger, cupola wet cap scrubbers meet the requirements of the original American Society of Mechanical Engineers' code which formed the basis of early air pollution control ordinances. However, effluent plumes are still dense and effluent loadings of about 0.20 gn/scf are higher than permitted by some ordinances. On the basis of quoted air flow, temperature, pressure drop, horsepower, and water specifications, venturi scrubbers will clean 5.4 lbs/min of dirty gases for each fan brake horsepower to a guaranteed outlet loading of 0.59 gn/scf. The flooded disc, or variable annulus, scrubber will clean 5.3 lbs/min of gases to a maximum effluent density of 0.05 gn/scf. A multiple-stage fluidized bed scrubber will clean 5.5 lbs/min of gases to a guaranteed grain loading of 0.05 gn/scf, but tests under normal operating conditions show that a loading of 0.02 gn/scf can be attained. Installed in pairs, centrifugal spray washers will clean 5.3 lbs/min of dirty gases to an outlet loading of 0.05 gn/scf, plus or minus 1%.

4657 APTIC NUMBER 13982

Yemel'yanov, B. V., Z. N. Shemyakina, and V. N. Shvarov
REMOVAL OF TETRAETHYL LEAD FROM AIR BY OZONIZATION ON A SOLID CATALYST. (Ochistka vozdukha ot tetraetilsvintsa okisleniyem ozonom na tverdom katalizatore). Text in Russian. Khim. Prom. (Moscow), 44(7):498-500, 1968. 14 refs.

Laboratory and pilot studies of the removal of tetraethyl lead from air by ozonization on solid catalysts are discussed. Activated charcoal was found to be a more effective catalyst than aluminum oxide or silica gel. Pilot operation with this process began in 1964, processing air at a rate of 500,000 cu m/hr at a cost of 5.53 kopecs per 1000 cu m. The catalyst was replaced every 4-6 months and the degree of purification in the second year of operation was 92% with no traces of mineral zinc or ozone in the purified air. Replacement of the catalyst and adjustment of the operating regime raised the degree of purity to 99% and reduced operating cost. This method is recommended for industrial application and for portable equipment to be used with various forms of gasoline transport.

MEASUREMENT METHODS

4658 APTIC NUMBER 14111

Altshuller, A. P.
ATMOSPHERIC ANALYSIS BY GAS CHROMATOGRAPHY. In: Advances in Chromatography, J. Calvin Giddings and Roy A. Keller (eds.), vol. 5, New York, Marcel Dekker, Inc., 1968, p. 229-262. 102 refs.

This is a state-of-the-art review of gas chromatographic techniques and a bibliography of the literature on their application to atmospheric sampling at or near ground level over both urban and nonurban areas. It includes work reported from 1958 through 1966 and discusses the emission of gases and vapors from urban activities and natural processes. Analysis of vehicular pollution sources, including internal combustion and diesel engines is to be considered later. The material evaluated covers sampling procedures for concentrating atmospheric samples and techniques for removing substances interfering with samples, static and dynamic calibration methods, and detectors used in atmospheric analysis. Detectors are compared with respect to analysis of inorganic gases, gaseous and vapor state hydrocarbons, higher-molecular-weight aliphatic and aromatic substances, oxygenated organic substances, peroxyacyl and alkyl nitrates, organic sulfur compounds, and halogenated organic substances. The review stresses the advantages of electron capture techniques for a variety of analytical problems. It also emphasizes the desirability of utilizing support-coated open tubular columns and flow programming in atmospheric analysis by gas chromatography.

4659 APTIC NUMBER 13979

Anfield, B. D. and C. G. Warner
A STUDY OF INDUSTRIAL MISTS CONTAINING SULPHURIC ACID. Ann. Occupational Hyg., 11(3):185-194, 1968. 20 refs.

Industrial processes which use sulfuric acid solutions produce acid mists, gaseous sulfur dioxide, and sometimes particulate sulfates as airborne contaminants. Environmental monitoring of airborne sulfuric acid mists, sulfur dioxide, and airborne ferrous sulfate concentrations was carried out in five industrial locations. A total of 398 samples were collected from the five locations using a filter head and Dreschel bottle technique. All the SO2 concentrations were below 1 ppm, far below the recommended level of 5 ppm. As acute effects are unlikely, the pollutant is not an immediate hazard. However, the possibility that long-term exposures of susceptible persons to such concentrations may cause chronic effects must be considered. There was a considerable range in H2SO4 levels, due to different processes in the various departments, the changes in rates of production, and the effects of natural and forced ventilation systems. The concentrations were far higher than those usually found in even the most polluted urban atmospheres and greatly exceeded the recommended level. As a result, remedial ventilation measures to improve the working conditions were introduced. Three factors which appeared to be involved in the formation of H2SO4 mists in the various industrial processes were the working temperature of the H2SO4 solution, the physical state of the solution (i.e. state of agitation), and whether there is a reaction which evolves hydrogen. The relative importance of the three factors was tested and it was found that when hydrogen is evolved, the transportation of acid mist into the atmosphere is greatly accelerated. It was likely that the effects of the inhaled acid mists will be mainly in the upper respiratory tract. Complaints of coughing, nose-running, and tooth erosion and discoloration were common. With higher concentrations, nose-bleeding can occur along with irritation of the eyes and exposed skin surfaces.

4660 APTIC NUMBER 14014

Antal, Simon
DISTRIBUTION OF LARGE AND GIANT ATMOSPHERIC AEROSOL PARTICLES OVER HUNGARY. (A legkori nagy- es orias-reszecskek horizontalis eloszlasa Magyarorszagon). Text in Hungarian. Idojaras (Budapest), 73(2):92-98, March-April 1969. 4 refs.

The applicability of the data obtained in the vicinity of Budapest concerning the vertical distribution of large and giant atmospheric particles to the entire territory of the Carpathian Basin is tested. Horizontal particle concentration measurements were executed at heights of 400 and 1200 m. It was found that the horizontal gradient for the range of particles under investigation was negligible. The distribution area of turbulent diffusion in the upper part of the friction layer was computed by using the measurements taken at the two heights. It was concluded that horizontal aerosol measurements may be used to analyze air masses. (Author abstract modified)

4661 APTIC NUMBER 13971

Benforado, D. M., W. J. Rotella, and D. L. Horton
DEVELOPMENT OF AN ODOR PANEL FOR EVALUATION OF ODOR CONTROL EQUIPMENT. Preprint, Air Pollution Control Assoc., 27p., 1968. 12 refs. (Presented at the 61st Annual Meeting of the Air Pollution Control Assoc., St. Paul, Minn., June 23-27, 1968.)

The use of a trained odor panel of six to eight members was found to have considerable practical applicability in the measurement and evaluation of industrial odors and control equipment. The panel was tested by the syringe dilution technique, in which odor strength is measured in terms of the 'number of dilutions of clean air' required to reduce the 'sample plus clean air mixture' to 'no odor'. Panel members were asked to inhale and evaluate three different dilutions of field samples of stack gas emissions; only positive or negative response as to the presence of odor in the syringe sample was reported. The odor strength of the exhaust gases was reported in odor units per standard cubic foot (scf); the odor unit was defined as the ratio of the cubic feet of clean air needed to dilute each 'cubic foot of contaminated effluent' so that 50% of the panel does not detect any odor in the diluted mixture. Results showed that if the odor strength of the stack gas can be reduced to less than 150 odor units per scf, preferably in the range of 25-50 odor units per scf, odor nuisances in a community can be prevented. By converting this measure to an odor emission rate, it appears that up to about one million odor units per minute is acceptable to avoid odor complaints from a single stack or for the combined

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effluent from a group of stacks. The odor panel method was used to judge the effectiveness of various types of ovens as control equipment. Results showed, for example, that with the use of wire enameling ovens, incineration produces a satisfactory effluent at 1400 F but is unsatisfactory at 1000 F. The method was judged to be a simple, inexpensive, and practical tool for quantitatively analyzing odors and for monitoring stack emissions to determine the efficiency of control equipment, and provides an easy method for obtaining field samples for laboratory analysis.

4662 APTIC NUMBER 14197

Binder, Heinrich
GAS-CHROMATOGRAPHIC INVESTIGATION OF VAPOUR PHASES. II. CRITICAL EXAMINATION OF DIFFERENT METHODS OF SAMPLING. (Zur gas-chromatographischen Untersuchung von Dampfphasen. II. Beurteilung verschiedner Methoden der Probennahme). Text in German. Z. Anal. Chem. (Munich), 244(6):353-359, 1969. 104 refs.

Odors, engine exhausts, aroma and cigarette smoke, urban air pollution, and quality of foodstuffs are among the problems that can be investigated by gas-chromatographic vapor phase analysis. Completeness of qualitative analysis and accuracy of quantitative analysis depend mainly on the type of collection and on enrichment and introduction of the sample. Several collection problems and the methods of their solution are described in detail. (Author summary modified)

4663 APTIC NUMBER 14076

Breuer, Wolfram
NEW METHODS CF CONTINUOUS TRACE ANALYSIS. (Neue Verfahren zur kontinuierlichen Spurenanalyse). Text in German. Arch. Tech. Messen, no. 396, p. 7-12, Jan. 1969. 2 refs.

A detailed description is given of two electrolytic continuous recording devices for measurement of small traces of gases present, for example, in atmospheric air. An earlier version with a liquid electrolyte was based on Nernst's concept of a concentration chain. The new version uses an organic substance as an electrolyte which has a high dielectric constant, a low electric resistivity, a low vapor pressure, is but slightly hygroscopic, and possesses a high melting point. This electrolyte is solid and is part of a monolithic, small and rugged unit. The accuracies of measurements made by these devices vary between dilutions of 10 to the minus 9th power and 0.000001, depending on the kind of gas. At present, the following gases can be determined with these accuracies: O2, O3, Cl2, NO2, NO2 plus NO, H2S, HCN, and COCl2.

4664 APTIC NUMBER 13972

Bykhovskaya, M. S.
DETERMINATION OF AMINAZINE IN AIR. (Opredeleniye aminazina v vozdukhe). Text in Russian. Gigiena Truda i Prof. Zabolevaniya, 13(3):58-60, 1969. 7 refs.

Aminazine (chlorpromazine) in aerosol form has dermatologic effects on workers producing and handling it at a level of 0.3 mg/cu m. The author investigated several methods for the determination of chlorpromazine filtered from contaminated air, principally the chloroform extraction procedure followed by colorimetric determination of the product formed by chlorpromazine and methyl orange. The lower limit of sensitivity of the determination was 5 micrograms per 5 ml solution at a pH of 3-4. This method was selected in preference to determination with picric acid or mercuric iodide because it was more sensitive in a larger volume of solution and was not affected by the presence of phenothiazine and its derivatives. The contaminated air flowing at a rate of 10-15 liters per minute was collected on a filter; a 50-100 liter sample was sufficient for analysis. The filter was washed with a small volume of distilled water and the resulting solution was analyzed.

4665 APTIC NUMBER 14129

Cederstrand, Carl N.
OPTICAL SMOKE MEASUREMENT: WHAT IT CAN AND CAN'T DO. Diesel Gas Turbine Progr., 34(6):44-45, June 1968.

The capacities of optics in diesel smoke measurements are analyzed, and problems associated with accurate readings for engines of various sizes with exhaust outlets of various sizes are discussed. The need for a sound physical basis for accurate photometric measurements is stressed. If measurements made on one plume are to be correlated with measurements made on another plume, the optical path length must be defined. In the case of different path lengths, readings from different measurements will have to be reduced mathematically to a common light path by means of the Beer-Lambert Law. The use of a standard-length light absorption cell is proposed in conjunction with all meters. In the case of appreciable variation in the volume of exhaust from different engines, volume variable must also be evaluated if smoke readings are to be related to the visual appearance of a plume. Smoke meters could be provided with nomographs to correct for volume of exhaust (engine displacement x rpm) or with velocity sensors for the automatic correction of readings for the volume of gas from any given source. Another alternative is the measurement of a physical unit that would plausibily describe plume appearance. Light absorbance (over a fixed path of 1 foot) might be multiplied by the cube root of the volume of exhaust emitted per unit time. Such a unit would be equivalent to multiplying the concentrations of the smoke by an average visual path length and by the Beer-Lambert Law.

4666 APTIC NUMBER 14177

Crider, Walter L., Arthur A. Strong, and Naomi P. Barkley
FLAME EMISSION INSTRUMENT FOR SELECTIVELY MONITORING FE203 AEROSOL IN ANIMAL EXPOSURE CHAMBERS. Appl. Spectry., 22(5):542-544, pt. 1 Sept.-Oct. 1968. 7 refs.

An instrument sensitive to Fe203 aerosol in the presence of other airborne contaminants was developed by combining the sampling system and principle of a spectrothermal emission instrument with the dc electronics of a chemiluminescence instrument. The instrument was calibrated over a range from 0.3 to 1.6 mg/m3, and the maximum sensitivity was found to be about 0.3 micrograms of Fe2O3 aerosol per cubic meter of air. It is presently being used to monitor continuously and control the Fe2O3 aerosol mass concentration in a 3-cubic-meter dynamic-flow animal exposure chamber.

4667 APTIC NUMBER 14163

DIESEL EXHAUST SMOKE: ITS CONTROL AND MEASUREMENT. Diesel Gas Turbine Progr., 34(6):40, 41, 43, June 1968.

Though it does not contribute significantly to air pollution, the diesel engine must meet pending federal and state smoke regulations. Leading engineers agree that these regulations can be met technically by current engine designs but disagree on effective ways to measure exhaust smoke in the field and on engine operating conditions required to evaluate engine smoke characteristics. Answers to these problems vary from measuring engine operation at full load under dynamometer-type conditions to timed intervals for lugging, with turbocharged engines, and timed intervals for accelerating, again with turbocharged engines. Other authorities feel that a no-load, fast-acceleration test from idle to full speed is a practical way to measure smoke levels, since the engine is loaded by the inertia of the moving parts and is also typical of a first-gear acceleration.

4668 APTIC NUMBER 14279

Ettre, L. S.
UTILIZATION OF CATALYTIC REACTIONS IN GAS CHROMATOGRAPHIC SYSTEMS. Franklin Inst. Research Labs., Philadelphia, Pa., Materials Science and Engineering Dept. and Public Health Service, Durham, N. C., National Air Pollution Control Administration, Proc. First Natl. Symp. on Heterogeneous Catalysis for Control of Air Pollution, Philadelphia., Pa., Nov. 1968, p. 349-358. 21 refs.

Out of a classification of eight reaction-gas chromatographic systems, four are discussed as being of interest in air pollution analytical instrumentation. (1) Microreactor-GC systems, in which the products of catalytic reactions are studied. Such systems might be used to investigate the influence of such reaction parameters as temperature, light, and catalyst activity on the reaction products. (2) Precolumn systems, in which the microreactor is placed between the injection block and the separation column. These might be used to analyze a complex hydrocarbon mixture of an automobile exhaust consisting of saturated and unsaturated compounds; they also have application to the 'carbon skeleton' chromatography technique. (3) Reactions between two separation columns. Such a system is useful if a given column cannot separate a certain substance, but the separation of some derivatives of the substance is easy. An example is presented of the analysis of the C4 hydrocarbon isomers, using a packed column containing dimethylsulfolane as the liquid phase. (4) Reaction between the separation column and the detector. These systems convert certain sample components to substances which can be detected with higher sensitivity; at present they are used mainly to increase the detection limit for inorganic substances by transforming them into methane which can be detected by the much more sensitive flame ionization detector. Methods of applying this technique to various compounds are described in the literature.

4669 APTIC NUMBER 14075

Fruengel, Frank
VIDEOGRAPH, A MEASURING DEVICE FOR ATMOSPHERIC TURBIDITY AND VISUAL RANGES. (Der Videograph, ein Messgeraet fuer atmosphaerische Truebung und Sichtweiten). Text in German. Arch. Tech. Messen, no. 396, p. 1-6, Jan. 1969. 6 refs.

The 'videograph' for measuring atmospheric turbidity and visual range incorporates in a hermetically sealed housing an optical projector provided with a photoflash tube of special design and forming a slightly upwards inclined beam, which emits light flashes of maximum luminous intensity of 10 to the 9th power candles/sq cm at the rate of 72 flashes/min and is surmounted by an optical receiver provided with a photoelectric cell whose optical axis intersects that of the projector at a distance of about 15 m from both. Thus, the receiver measures the intensity of light backscattered by aerosol particles illuminated by a flash within the volume of intersection of the projector and receiver beams lying in the interval extending from 10 to 30 m away from the videograph. The design of the photoflash projector and the photoelectric receiver for temperature insensitivity and long-term stability is described in detail. The videograph is equipped with an automatic autodiagnostic circuit and a shut-off block, and it transmits an alarm signal to the central station in the case of malfunctioning or failure. A separate backscatter calibrator, named 'Vivical', was developed for calibration of the videograph and incorporates two diffuse reflectors, from which scattered light simulates the light backscattered by droplets in naturally-occurring fogs.

4670 APTIC NUMBER 14288

Guerrant, Gordon O.
METHOD AND APPARATUS FOR CONTINUOUS MONITORING OF FLUORIDE EFFLUENT. (USS Agri-Chemicals, Inc., Pittsburgh) U. S. Pat. 3,461,043. 3p., Aug. 12, 1969. 5 refs. (Appl. May 3, 1965, 7 claims).

The invention relates to a process and apparatus for the continuous monitoring of fluoride effluent by internal electrolysis. It is particularly suited to the remote monitoring of fluoride evolution in phosphate fertilizer manufacturing processes or to the determination, either in the field or on plant premises, of fluorides in waste gases. Monitoring is accomplished by contacting fluoride-containing gas with a dilute acid electrolyte, which forms a film on the tubing walls on which the fluoride is absorbed, and then passing the electrolyte from which gas has been removed through an electrolysis cell provided with electrodes for spontaneously generating current flow, withdrawing the electrolyte, and measuring the current flow. Since the electrolyte flows by gravity into the tubing, minimum electrolyte volume is required for absorption of gaseous fluorides to provide maximum response.

4671 APTIC NUMBER 14213

Haentzsch, Siegfried, Frank Nietruch and Karl-Ernst Prescher
CONTINUOUS DETERMINATION OF NITROGEN DIOXIDE IN THE AIR WITH AN AUTOANALYZER. (Kontinuierliche Bestimmung von Stickstoffdioxid in Luft mit dem Autoanalyzer). Text in German. Mikrochim. Acta (Vienna), no. 3:550-556, 1969. 17 refs.

For continuous nitrogen dioxide measurement in air, a Technicon autoanalyzer was used. A sample gas flow was drawn in through a reaction zone where it was brought in contact with a Saltzman solution. After reaction with the nitrogen dioxide, the major part of the solution went to a colorimeter. The transparency of this solution was measured and recorded. The following reaction zones were used: a siphon, a vertical reaction tube of about 60 cm length and 3.2 mm inner diameter, the gas sample and reagent passed in parallel flow, as well as in counter flow, through the tube, a helical tube, and a micro frit for continuous flow of the Saltzman solution. For calibration, a continuously produced mixture of NO2 and air was used. In all types of reaction zones, reliable NO2 measurements were obtained. The measured concentrations were found to lie in the maximum allowable concentration range (present long-term maximum allowable concentration equal 1 mg/cu m). With the 60 cm tube, it was found that neither the flow velocity nor the direction of the gas sample had any influence on the measured value. An adjustment time of 2 min was required for NO2 concentrations between 0.32 and 3.2 mg/cu m. In the 20 m tube, adjustment took about 60 min at concentrations between 0.11 and 1.10 mg NO2/cu m. For the micro frit, a low-volume container must be used for the adjustment period to remain short. The detection thresholds were found to be 5 micrograms/cu m for the 20 m helical tube and 0.15 mg/cu m for the 60 cm tube. The only disadvantage of the method is the complicated calibration process.

4672 APTIC NUMBER 14080

Haughey, Francis J. and Raymond [illegible]ganelli
AN EXPERIMENTAL SYSTEM FOR AEROSOL RESEARCH. Am. Ind. Hyg. Assoc. J., 29(3):268-278, May-June 1968. 13 refs.

An aerosol test system which permits the study of the interactions between aerosol particles, carrier gas, and various pollutants, including radioactive atoms and ions, is described. The study of surface properties of aerosol particles is accomplished by sampling the aerosol mixtures through a scattered light sensor-multichannel analyzer combination. Changes in coagulation rate or increased wall loss were evident, since both size distribution and concentration are monitored continuously. Aerosol flow is controlled by means of solenoid valves. Read-out of particle data from the multichannel analyzer is by typewriter, recorder, and punched paper tape for input to an IBM 1620 or 7040 computer for calculation of particle distribution parameters. The flexibility of the system was shown in studies involving carbon, titanium dioxide, and fly ash particles in nitrogen, argon, and argon plus water vapor carrier gases and the daughters of radon 220.

4673 APTIC NUMBER 14157

Hochrainer, Dietrich and Paul M. Brown
SIZING OF AEROSOL PARTICLES BY CENTRIFUGATION. Environ. Sci. Technol., 3(9):830-835, Sept. 1969. 11 refs.

Two centrifuge-type aerosol spectrometers, one cylindrical and one conical in design, employing the rotating ring slit principle of Berner and Reichelt were built and tested. The aerodynamic diameter of aerosol particles is defined as the diameter of a sphere of unit density having the same terminal velocity as the aerosol particle in a given gravitational or centrifugal force field and gas of same viscosity. For many applications, like deposition in the lung and other areas of the respiratory tract, or scavenging by water droplets in the atmosphere, the aerodynamic diameter is more significant than optically-measured diameters. These spectrometers precipitate aerosol particles on removable foils according to their aerodynamic diameter in centrifugal force fields up to 5000 G. The foils, having simple geometries, are easily analyzed for size distribution of deposited aerosols. The instruments are designed to provide the clean air required in their operation without the use of external apparatus, eliminating the need for auxiliary equipment normally used and, especially, eliminating the need for rotating seals. Although both centrifuges will precipitate particles in the aerodynamic diameter range of 0.1 to 5 micrometers with good size resolution, the conical model will do so in a single operation. A second foil may be placed in the conical model upon which relatively large amounts of aerosol particles are precipitated in a cumulative size distribution. Detailed descriptions are presented of the structure and performance of these centrifuges and of the theory of centrifugal deposition. (Author abstract modified)

4674 APTIC NUMBER 14328

Hochreiter, Frederick C.
DEVELOPMENT OF TRANSMISSOMETER CALIBRATION TECHNIQUES AND DEVICES, PHASE I. INTERIM REPORT. Environmental Science Services Admin., Atlantic City, N. J., Test and Evaluation Lab., Inter-Agency Agreement FA-65, WAI-96, Proj. 450-401-05E, RD-68-7, 67p., Feb. 1968. 16 refs.
AD 673263

The transmissometer system measures transmittance of the atmosphere, which is the basic input used in determining runway visibility. Two side-by-side 250-ft baseline transmissometers were used to determine calibration techniques that could be useful under all visibility conditions without the aid of specialized devices. Current calibration procedures are limited to application in visibilities of 5 miles or more. A review of these procedures is presented. Testing anticipates extending some calibration techniques to visibilities less than 5 miles.

Preventive maintenance procedures which may be used to minimize transmissometer outages are discussed. Inspection of Weather Bureau Electronic and Maintenance Summaries show that timely replacement of the projector lamps will reduce lamp failures to near zero. Interim results of testing show that the practice of aging CE-75 phototubes should not be overlooked. The Appendix presents detailed transmissometer alignment and calibration procedures reflecting current techniques. (Author abstract modified)

4675 APTIC NUMBER 14201

Hofmann, P. and P. Stern
PHOTOMETRIC DETERMINATION OF LOW OZONE CONCENTRATIONS IN WATERS. (Photometrische Bestimmung Niedriger Ozonkonzentrationen in Waessern). Text in German. Anal. Chim. Acta, 47(1):113-120, Aug. 1969. 6 refs.

A spectrophotometric method is described for the determination of ozone in water down to a 0.01 mg/l level. Ozone reacts with the manganese(II) disphosphate complex to form the manganese(III) diphosphate complex which is then reacted with o-toluidine. If ozone is swept out of the sample by a stream of gas and absorbed in manganese(II) diphosphate solution in the presence of chromium(III) as a catalyst, the method can be applied to heavily polluted waters; at the 0.52 mg/l level, the standard deviation was 3.1%. The method can be easily adapted to the determination of ozone in gases. (Author summary modified)

4676 APTIC NUMBER 14210

Jung, R.
SAMPLING PROBE FOR THE MEASUREMENT OF DUST CONCENTRATIONS IN FLOWING GASES. (Gefaesssonde zum Messen des Staubgehaltes in stroemenden Gasen). Text in German. Chem. Ing. Tech., 41(10): 620-625, 1969. 6 refs.

The efficiency of a dust concentration measuring unit consisting of a tube with a sampling hole is computed. The gas flows perpendicularly to the tube; part of the dust originally headed for the hole is deflected by the rim of the hole and thus escapes measurement. The fraction of dust lost to measurement is computed with the aid of aerodynamic laws. A diagram shows the measurement error vs a variable, B, which is a function of the particle velocity relative to the tube, of the terminal velocity, and of the probe diameter. It can be seen that the probe can be used only if B is greater than 3.5. To confirm the theoretical finding, experimental measurements were taken in a circular tube which rotated in the measurement section with the radially arranged probes around the axis. The collected dust quantities thus represent the average dust flow densities. Comparison of theoretical and empirical results shows that at air velocities of 3.5 to 27 m/sec, the measured points deviate on the average by about 2% from the theoretical curve. Generally, it was found that the probe is suited for low dust concentrations only.

4677 APTIC NUMBER 14253

Knight, Charles A.
SMALL PARTICLE DETECTION AND IDENTIFICATION BY CRYSTAL GROWTH: PRELIMINARY WORK ON AGI PARTICLE DETECTION. J. Appl. Meteorol., 8(4):705-707, Aug. 1969. 8 refs.

An idea for the detection and identification of small crystalline particles and some preliminary work on the application of the method to beta AgI particle detection are reported. The method is to introduce the unknown particles into an environment that is supersaturated with AgI. Then if the crystals grow there is a more or less strong presumption that each crystal grew from a particle of AgI and that each AgI particle grew to a larger crystal. Two general questions involved in the technique are the interferences that might be expected from heterogeneous nucleation by foreign particles in the test sample and the size limitations of detection imposed by the increase in crystal solubility with decreasing size. An environment was selected that could be supersaturated with AgI to an easily controllable degree. A 3000 ml solution of 30% KI by weight was prepared and a generous excess of AgI was added. A substrate upon which the particles were to be deposited was added to the solution. Preliminary tests were done on glass slides from which drops of very fine suspensions of silver iodide had evaporated. After drying, both AgI and KI were present, but the presence of KI did not interfere with AgI crystal growth. Efforts to determine size sensitivity of the method proved difficult because there is no identification method for particles less than 1 micron in diameter that could be used in conjunction with the technique. Particles developed down to 0.6 micron when AgI powder was shaken in plastic bottle and allowed to settle. Particles produced by blowing air over molten AgI developed into crystals down to 0.17 micron. However, only a small portion grew over the entire size range and the remainder neither grew nor dissolved. It was suggested that crystals do not grow because they are dislocation-free, and supersaturation is not great enough to initiate growth by two-dimensional nucleation. If AgI content correlates with the structures of individual growth shells, particularly with crystal size, it may be possible to gain some direct information on the action of the AgI particles within the clouds.

4678 APTIC NUMBER 14037

Kotnick, G. and H. F. Scheck
MONITORING SO2 IN STACKS. Instrum. Technol., 16(9):52-55, Sept. 1969.

The available methods for measuring sulfur dioxide in stack gases are described. These techniques are divided into wet chemical, dry chemical, ultraviolet absorption, and infrared absorption types. The wet and dry chemical tests, which are usually performed manually, are treated very briefly, while the ultraviolet and infrared methods, typically employing automatic and continuous instruments, are described in detail. In the ultraviolet category, the Barringer AISI sulfur dioxide monitor requires no sampling system and depends primarily upon daylight as its sources of ultraviolet radiation. The plant operator aims a viewing unit at the stack plume; the ultraviolet is absorbed by the sulfur dioxide in the flue gas, and the analyzer measures this absorption. The simplest system with a sampling train is the Barringer stack gas monitor, in which the analyzer is mounted in the stack itself and optically analyzes the stack gas as it flows by; the sulfur dioxide in the flue gas absorbs ultraviolet radiation from a quartz-iodine lamp. Another ultraviolet system by DuPont Co. is mounted outside the stack; the analyzer has ranges as low as 200 ppm sulfur dioxide and can tolerate a great amount of light reduction without a corresponding decrease in accuracy. The three systems described that utilize infrared radiation are those manufactured by Beckman, Leeds and Northrup Co., and the Mine Safety Appliance Co. The last of these has a variable scale of 500 to 2000 ppm; interference by other stack gases such as water vapor, carbon dioxide, and nitrogen oxides is eliminated by a positive/negative filtering technique.

4679 APTIC NUMBER 13969

Krotoszynski, B. K. and A. Dravnieks
ODOR-RELEVANT MEASUREMENT OF ODOROUS POLLUTANTS IN AIR. Preprint, Air Pollution Control Assoc., 17p., 1968. 6 refs. (Presented at the 61st Annual Meeting of the Air Pollution Control Assoc., St. Paul, Minn., June 23-27, 1968, Paper 68-17.)

Equilibration sampling, a recently developed technique for measurement of ppb concentrations of organic vapors in air, is described. This method facilitates the analysis of air for odorants characteristic of the sources in the environment and the comparison of the concentrations of these odorants in air with their threshold concentrations. The air sampler consists of a glass cylinder equipped with two stainless steel screens between which Teflon powder, coated with Apiezon L film, can be maintained in a floating state by air sample rapidly pulled through the sampler by means of a battery-powered air fan. Vapors dissolve in the film until an equilibrium is reached; the collected vapors are then transferred to a gas chromatograph and analyzed. One of the advantages of the technique is that the headspace of the sampler contains odor of approximately the same intensity and quality as the original air, and the films contain a sufficient reserve of odorants to keep supplying odor for a period of time sufficient for psychophysical evaluation in the laboratory. The method can be easily adapted to calibration in terms of odor thresholds without an intermediate need for calibration by weight or concentration, and the original gas chromatogram can be converted to a representation in terms of odor threshold units of each odorant, enabling an improved comparison of the odorant components. This permits judgements to be made on the factor by which the concentration of an odorant in air and in the emission from its source must be reduced to suppress its value to a given level below threshold. Theoretical considerations and experimental procedures are described, and some results are given showing determination of group thresholds and of peak areas at group threshold concentrations for selected pollutants.

4680 APTIC NUMBER 14278

Lee, Robert E., Jr. and Jerome P. Flesch
A GRAVIMETRIC METHOD FOR DETERMINING THE SIZE DISTRIBUTION OF PARTICULATES SUSPENDED IN AIR. Preprint, Air Pollution Control Assoc., 15p., 1969. 12 refs. (Presented at the Air Pollution Control Assoc., Annu. Meet., 62nd, New York, June 1969, Paper 69-125.)

Particle size distribution data for suspended particulates is difficult to obtain because of many disadvantages in available fractionating devices. Such data is important in assessing inhalation hazards, because the degree of respiratory penetration and retention is a direct function of aerodynamic particle size; this parameter also affects many atmospheric phenomena. A device is described to overcome current difficulties in collecting these data. A modified Andersen cascade impactor was operated for 24-hour periods at 4 to 5 cu ft/min rather than the designed 1 cu ft/min air flow rate to fractionate and collect suspended particulates in quantities sufficient for gravimetric measurements with an analytical balance. The higher air flow rate was made possible by removing the sixth impactor stage. The impactor measured the particle size distribution over a range of about 3 to 0.5 micron diameter as unity density spheres. Full technical details, data, and diagrams are given of the assembly and performance of the sampler, and calculations for determining the effective cutoff diameter for each impactor stage as a function of the air flow rate are described. Field tests gave size distributions that were approximately log-normal. The distributions were fairly uniform from day to day; mass median diameter values were 0.75 to 1.48 microns, and the standard geometric deviation, a measure of dispersion, ranged from 1.6 to 3.4. The entire sampler can be assembled from commercially available components for about $500, making it accessible to almost any air pollution program. The sampler is especially suited to network operation because in addition to its low cost, it is rugged and fairly easy to use. The National Air Surveillance Networks plan to initiate a modest network of these samplers to supplement the high-volume air sampling network.

4681 APTIC NUMBER 14109

Leonardos, Gregory, David A. Kendall, and Nancy J. Barnard
ODOR THRESHOLD DETERMINATIONS OF 53 ODORANT CHEMICALS. Preprint, Air Pollution Control Assoc., Pittsburgh, 23p., 1968. 4 refs. (Presented at the 61st Annual Meeting of the Air Pollution Control Assoc., St. Paul, Minn., June 23-27, 1968, Paper 68-13.)

Recognition odor thresholds for 53 commercially important chemicals were determined in the laboratory by an expert panel of four members. By standardizing the method of sample presentation and minimizing extraneous sensory interference, the concentrations determined as producing the minimum identifiable odor response provided consistent and internally comparable data for one parameter of odor. The odorants were presented to the panel in a static air system utilizing a low-odor background air as the dilution medium. The odor threshold was defined as the first concentration at which all panel members were able to recognize the odor. Aspects of human odor detection and of the concept of the odor threshold are discussed. The thresholds determined for each odorant in terms of parts per million by volume are presented. The minimum threshold observed was with trimethyl amine at 0.00021 ppm. As a group, compounds with sulfur had the lowest thresholds of the compounds tested. It was noted that carbon disulfide, sulfur dichloride, and sulfur dioxide affect the other chemical senses (taste and feel) as well. The presence of unsaturation in an odorant chemical was not found to be associated with low threshold concentrations, and it is observed that extended generalizations pertaining to the odor threshold based on similar chemical structures cannot easily be made. With reference to benzenoid-type materials, substitution on the benzene ring reduced the odor threshold by as much as a thousandfold depending on the nature of the group added, and in general produced a wide variation in thresholds. Three chemicals, toluene, styrene, and tolylene diisocyanate were purified by a gas-liquid chromatography to note the effect of chemical purity on the odor threshold; differences from thresholds determined from starting materials seemed slight, if any.

4682 APTIC NUMBER 14272

Marsh, K. J. and V. R. Withers
AN EXPERIMENTAL STUDY OF THE DISPERSION OF THE EMISSIONS FROM CHIMNEYS IN READING. III: THE INVESTIGATION OF DISPERSION CALCULATIONS. Atmos. Environ., vol. 3:281-302, 1969. 11 refs.

Six-hr concentrations of sulfur dioxide were measured at 40 sites in Reading, England during a 15-month period, together with the relevant meteorological data. An inventory of the sources was compiled and the meteorological data was employed in testing dispersion models for calculating pollution. Two models were used: one treating housing areas as crosswind line sources and individual sources as single chimneys; another treating both areas and sources as single chimneys. The application of these models to all 40 sites by means of the selected meteorological data showed that the root mean square error of the estimates was roughly equal to the mean of the observed concentrations. In all these tests, regression equations were calculated from the same data, comparing concentration measurements with a parameter derived from air temperature and wind speed. The root mean square errors from these were consistently lower than those from the dispersion models. Empirical equations, based on the same parameters, but also including various functions of the distribution of sources around each measuring site, were then tested with the same data used for the dispersion models. These gave better estimates of the observed concentrations. It is concluded that dispersion equations do not provide a satisfactory basis for calculating the pollution from extended sources such as housing areas. The better precision given by the empirical equations suggest that a model for extended areas should be developed on the same lines, while retaining the dispersion equation for the tall chimneys. In densely populated countries, pollution models must account for the effects of pollution coming from cities other than the ones under consideration. (Author abstract modified)

4683 APTIC NUMBER 14125

Matsushita, Hidetsuru, Yasutomo Suzuki, and Hiroyuki Sakabe
A SPECTROFLUOROMETRICAL METHOD FOR DETERMINATION OF 3,4-BENZPYRENE IN BENZENE SOLUTION CONTAMINATED WITH 3,4-BENZFLUORANTHENE OR 3,4-BENZFLUORANTHENE AND 1,2-BENZPYRENE. Ind. Health, (Japan), vol. 3:107-120, 1965. 11 refs.

A spectrofluorometric method is proposed which consists of removing oxygen dissolved in a test solution, measurement of fluorescence, and determination by a narrow base line method as outlined by Commins. By this method, 3,4-benzopyrene can be determined accurately even in a solution containing 3,4-benzopyrene, 3,4-benzofluoranthene and 1,2-benzopyrene in a concentration ratio of 1:100:100. This method has an advantage over the ordinary peak method in that it eliminates interference of the contaminants which may be attributed to the following facts. Fluorescence intensities of the contaminants change in an approximately linear manner over the narrow range of wavelength near 405 millimicrons and removing the oxygen makes the characteristic peak of 3,4-benzopyrene distinct at 405 millimicrons. However, the narrowing of wavelength range has some limit, as it results in a decrease in peak height and drop in sensitivity. The base line which connects the two points 25-30A distant from the 405 millimicron peak on either side is assumed to be most suitable for the determination of 3,4-benzopyrene in the benzene solutions contaminated with impurities. Selection of a excitation source seems to be an important factor to minimize interference of contaminants, although in this case only 366 millimicron mercury light was used. If the exciting light is so selected that it is absorbed strongly by 3,4-benzopyrene and weakly by contaminants, the present method will be also useful for the determination of 3,4-benzopyrene in a solution contaminated with various other polynuclear hydrocarbons.

4684 APTIC NUMBER 14300

May, K. R.
PROLONGATION OF MICROBIOLOGICAL AIR SAMPLING BY A MONOLAYER ON AGAR GEL. Appl. Microbiol., 18(3):513-514, Sept. 1969. 4 refs.

Large volumes of air must be sampled to catch viable virus and bacteria aerosols. Sampling by impaction on gel surfaces, as is done in slit samplers and the Andersen sampler, is simple, but prolonged sampling in dry, warm conditions is restricted by loss of water and shrinkage of the gel. The useful life of these samplers is extended by treatment with a dilute emulsion of oxyethylene docosanol, which forms a monomolecular layer on the water to suppress evaporation. With normal agar, a deep dent forms under each impaction jet due to local drying of the agar; this dent must alter impaction characteristics. Treated agar surfaces remain smooth and unaltered, even after prolonged sampling. Oxyethylene docosanol does not affect the growth of any type of colony and should increase the collection of viable particles on gel surfaces. It could prove useful in Litton high-volume samplers and in May multistate impingers.

4685 APTIC NUMBER 14117

DETERMINATION OF SULFUR DIOXIDE AND HYDROGEN SULFIDE. (Mine

Safety Appliances Co., Inc., Pittsburgh) Brit. Pat. 1,084,469. 6p., Sept. 20, 1967. (Appl. Dec. 14, 1964, 17 claims).

A method for detection and quantitative determination of sulfur dioxide and mixtures of sulfur dioxide and hydrogen sulfide in other gases was developed. This invention is based on the fact that a color change occurs when air or other gas containing sulfur dioxide is passed through a bed of indicator. The indicator consists of glass beads with an adherent sodium carbonate film impregnated with Phenol Red or Bromothymol Blue. When using Phenol Red the color change is from pink to yellow; when using Bromothymol Blue, from blue to yellow. Since the indicator does not react with or retain any hydrogen sulfide, the gas sample effluent may be passed through another indicator bed which is responsive to hydrogen sulfide. Activated alumina impregnated with silver cyanide is suggested for determining the presence of hydrogen sulfide.

4686 APTIC NUMBER 13974

Brose, H.
DETERMINATION OF HYDROCARBON CONTENT OF THE AIR BY GAS CHROMATOGRAPHY. (Bestimmung des Kohlenwasserstoffgehaltes der Luft mit Hilfe der Gaschromatographie). Text in German. Z. Meteorol., 20(1-6):60-67, 1968. 9 refs.

A flame ionization detector installed at the outlet of an appropriate gas chromatographic column permits direct measurements for quantitative and qualitative analysis of atmospheric hydrocarbons up to 0.1 ppm. Traces two orders of magnitude smaller must be analyzed in concentrated form. The physical-chemical fundamentals of gas chromatography are briefly summarized, as is the function of the detector. An experimental apparatus which shows the stated sensitivities is described. (Author abstract modified)

4687 APTIC NUMBER 14298

Noweir, Madbuli H. and Jacob Cholak
GAS CHROMATOGRAPHIC DETERMINATION OF BERYLLIUM IN BIOLOGICAL MATERIALS AND IN AIR. Environ. Sci. Technol., 3(10):927-930, Oct. 1969. 13 refs.

The gas chromatographic determination of ultratrace quantities of beryllium in urine, blood, tissue, and airborne dust is described. The method has application when only small quantities of the material to be analyzed are available or when it is suspected that the quantities of beryllium present are likely to be less than, or near, the limit of detection by the more variable spectrographic method. The sensitivity is such that only one-thirtieth the amount of sample used in the spectrographic method is required to attain the sensitivity of 0.01 microgram/L of urine, per 100 grams of tissue, or per cu m of air. However, the method also performs satisfactorily for higher concentrations of beryllium. Except for airborne dust, the method involves a double extraction, first with acetylacetone in benzene and then with a benzene solution of trifluoracetylacetone. Beryllium in airborne dust is extracted only by trifluoracetylacetone in benzene. Levels as low as 0.0001 microgram of beryllium per sample can be determined by this method. Except for Fe(3 plus) and Al(3 plus), none of the ions usually present in airborne dust or biological material interferes with the analysis. Ferric ion is removed in a magnetic mercury cathode; Al(3 plus) can be precipitated with 8pquinolinol in chloroform. Recovery of beryllium ranged from 70 to 90% at levels from 0.001 microgram to 0.10 microgram per sample. The method is reliable, as shown by the results of analysis of airborne dust and lung tissues. (Author abstract modified)

4688 APTIC NUMBER 13989

Oblaender, K. and D. Kraeft
DETOXICATION OF AUTOMOTIVE EXHAUST GASES - MEASURING METHODS AND TEST CYCLES. (Abgasreinigung an Kraftfahrzeugen - Messverfahren und Testzyklen). Text in German. ATZ (Automobiltechnische Zeitschrift) (Stuttgart), 71(4):117-124, 1969. 24 refs.

Detoxification of automotive exhaust gases raises not only motor engineering problems but also measurement engineering problems. The various methods for measurement of CO based on heat conductivity, on heat evolution and an infrared absorption are discussed and compared. The disadvantages of hydrocarbon measurements in the hexane range and of the flame ionization method are pointed out. Also discussed are the measurement of nitric oxide and the existing and planned multi-stage test cycles. A brief discussion of the possibilities of lowering the exhaust gas emission by motor modifications, the effects of traffic, and the fuel composition is included.

4689 APTIC NUMBER 14192

Okuda, N. and K. Okuda
ON THE SIMPLIFIED SMOKE INDICATOR OF RINGELMANN TYPE. (Ringeruman shiki kani baien nodo sokutei ni tsuite). Text in Japanese. Netsu Kanri (Heat Engineering) (Tokyo), 20(6):16-22, June 1968. 5 refs.

The Ringelmann indicator for measuring smoke density depends on the visual comparison of observed smoke with reference tables. A new, simplified Ringelmann-type indicator was constructed and consists of two tubes resembling a telescope. A film of the Ringelmann chart is inserted between two layers of transparent glass and mounted at the end of one tube. For viewing, the observer sets the tubes at a distance equivalent to the 16 m Ringelmann observing distance. Measurement is easy, reliable, and not affected by chimney background or weather.

4690 APTIC NUMBER 14107

Ramirez-Munoz, J.
SENSITIVITIES IN ATOMIC ABSORPTION SPECTROPHOTOMETRY. II. AS, AU, CA, CR, CO, FE, GA, IN, K, MG, MN, NI, PD, PT, RH, SE, TE, TL, AND ZN. Flame Notes, Beckman, 1(2):38-41, 1966.

Previous studies of sensitivities were continued on 19 elements, many of which are commonly determined by atomic absorption spectrophotometry. All data were obtained with an atomic absorption spectrophotometer equipped with laminar flow burner with both hot and cold operation; a triple-pass optical system was also used in the unit. Results are presented in tabular form. Improved performance in both percentual and fluctuational sensitivities was obtained by use of the triple-pass system for Cr, Cu, Au, In, Hg, Mn, K, Te, and Tl. The system is not recommended in the determination of As or Se because of the severe loss in energy at the low wavelengths involved. The results indicate that many elements, including Ca, Cr, Cu, Mg, Mn, K, and Zn, can be detected at concentration levels below 1 ppb, and thus support the value of atomic absorption spectrophotometry for trace techniques. The qualification is made, however, that these data were obtained under idealized conditions.

4691 APTIC NUMBER 14173

Sharkey, A. G., Jr., J. L. Shultz, T. Kessler, and R. A. Friedel
DETERMINING ORGANIC CONTAMINANTS IN AIR AND WATER. Res./Dev., 20(9):30-32, Sept. 1969. 14 refs.

In this limited investigation of organic contaminants in airborne particulate matter and treated sewage, the potential of the high-resolution mass spectrometer for expanding the knowledge of pollutants in air and water supplies is demonstrated. A major advantage of this type of instrumentation is that the elemental compositions of a wide variety of components can be determined on essentially total samples. Information concerning alkyl derivatives, such as carbon number distribution data obtainable by mass spectrometry, could be of prime importance in studies of carcinogenic pollutants. A limitation is that particular isomers cannot be determined. Combined gas chromatographic-mass spectrometric techniques, particularly with the use of high-resolution mass spectrometry in this combination, will increase the usefulness of the method for studies of organic pollutants. Data are presented on ten typical airborne pollutants to illustrate the applicability of the high-resolution technique to detect and determine the elemental composition of polynuclear species in atmospheric particulate matter. Additional data are given to illustrate the ability of the instrument to detect organic compounds having the same nominal molecular weight but different precise mass resulting from the presence of heteroatoms. (Author conclusions modified)

4692 APTIC NUMBER 14271

Shirvaikar, V. V., Ramesh K. Kapoor, and L. N. Sharma
A FINITE PLUME MODEL BASED ON WIND PERSISTENCE FOR USE IN ENVIRONMENTAL DOSE EVALUATION. Atmos. Environ., vol. 3:135-144, 1969. 1 ref.

Dose measurements for evaluating the hazards of emissions from nuclear reactors are usually based on finite period releases of the effluent. The dose at any distance downwind is then calculated by multiplying the concentration from a continuous point source plume by the period of release. This method is unrealistic because it assumes a very large persistence of wind direction and diffusion conditions. The possibility exists that a change in the mean wind direction occurring at some point during the period of emission could lead to a spread of the material over a far wider area than is possible by turbulent fluctuations. Therefore, the worst meteorological condition defined for any reactor site should include information about wind direction persistence and associated lowest mean wind speed. In this paper, a plume model for release in finite wind persistence periods is developed. Equations are presented for computing dosage during the period of persistent wind direction and dosage due to the transit of the oblique plume in the changed wind direction at the end of the persistence period. The equations take into account the change in diffusion conditions before and after the wind direction change. Good agreement exists between approximate values and numerically integrated dosages computed on a CDC 3600 computer. (Author abstract modified)

4693 APTIC NUMBER 12667

B. Shleien, M. A. Wall, D. Lutz
ESTIMATION OF RADIATION DOSES TO THE RESPIRATORY TRACT FROM INHALATION OF AIRBORNE RADIOACTIVITY. Environ. Sci. Technol., 5(6):438-443, June 1968. 14 refs.

A "graded filtration" sampler developed to estimate the respiratory deposition of airborne fallout provides information which when used with a suitable lung model permits estimation of the radiation dose to the nasopharyngeal, tracheobronchial, and pulmonary regions of the adult respiratory tract. Estimated doses to adults from airborne fallout collected in November 1966 and January 1967 were 85 and 130 microrem per 70 years to the nasopharyngeal and pulmonary regions of the respiratory tract, respectively. Estimated radiation dose to the tracheobronchial region was less than 0.01 microrem per 70 years. A dose of 225 microrem per 70 years to the thyroid gland was estimated due to inhalation. The greatest single dose commitment from fresh fission products was to the respiratory lymphatic nodes due to inhaled 144Ce and 144Cr. This was approximately 40 times the pulmonary region dose. Among long-lived radionuclides, 239Pu delivered the greatest dose to the respiratory lymph nodes. Doses to the respiratory tract from the levels of airborne fresh fission products encountered in this study are low when compared with nonoccupational radiation doses due to inhaled radon and its short-lived daughters. This approach to estimation of respiratory doses is applicable to monitoring of nuclear facilities for airborne particulate hazards evaluation. (author's Abstract)**

4694 APTIC NUMBER 14160

Shono, Toshiyuki and Koichiro Shiura
DETERMINATION OF METALS IN AIRBORNE DUST BY FLUORESCENT X-RAY SPECTROMETRY WITH FILTER PAPER TECHNIQUE. (Roshi ho keiko X sen bunseki ni yoru fuyu funjin no bunseki). Text in Japanese. Bunseki Kagaku (Japan Analyst) (Tokyo), 18(8):1032-1034,

1969. 4 refs.

Fluorescent X-ray spectrometry with a filter paper technique was applied to the determination of metals in airborne dust. Dust was collected on the filter paper using a high-volume air sampler and the intensity of the characteristic radiation of each heavy metal in the dust against the surrounding background was counted by a fixed-time method. The metal acetylacetonates were used as metal standards. Regression analysis was applied to derive the calibration line between the ratio (counts for standard sample:counts for sampling filter paper) and the metal content. The concentrations of metals on the filter paper were calculated from the calibration lines and converted into values per unit volume of air. Metals determined in the dust were titanium, iron, zinc, and manganese. Values obtained by the X-ray method agreed well with those obtained by colorimetric methods. (Author abstract modified)

4695 APTIC NUMBER 14267

Stokes, E. A. and K. D. Mulcaster
AIR FILTRATION - 6. Steam Heating Eng. (London), 38(448):32-37, March 1969.

The basic forms of in-place testing of air filter installations to ensure the required levels of performance are described. Smoke bombs or other forms of detectors, ignited on the upstream side of the filters when the fans are in motion, will indicate by visual means any large areas of leakage past the filters or from faults in the duct or building work. However, where standards to prevent the entrance of erit of harmful particles are rigid, as in radioactive processes, bacterial or pharmaceutical preparations, and research and clean rooms, visual observation is inadequate to detect the very small leakages that might be dangerous. In such cases, the method normally used is photoelectric detection of the smoke particles to produce a read-out on an electrical meter to indicate the concentration of smoke particles in an air sample. Another form of in-place testing compares particle size penetration with particle size presented. Many methods for determining particle size and concentration in the air are available; several are reviewed here, including dust collection, use of the relatively inexpensive cascade impactor and suction pump which, however, involve tedious visual examination of dust deposits, and the various types of electronic particle counters. The final testing method described compares mass penetration with mass presented, and involves determining the weight of dust or contaminant. Apparatuses are available for sampling the air through special filter paper and then comparing the blackness or opacity of the stain visually or photoelectrically with prepared standards. Another method is to sample large enough quantities of air through a membrane, filter paper, or gas washing bottle to result in a weighable sample of dust being collected. The advantages and drawbacks of the various processes are reviewed.

4696 APTIC NUMBER 14150

Sumansky, Ladislaus Walter

GAS SAMPLING PROBE. (United States Steel Corp., Monroeville, Pa.) U. S. Pat. 3,459,047. 3p., Aug. 5, 1969. 3 refs. (Appl. June 21, 1967, 2 claims).

The invention described relates to probes for sampling gas flowing through a gas main and has particular application to probes of gases, such as coke oven gases, which contain suspended solids or have a tendency to condense to solids or liquids below a specific temperature. It is designed to prevent the clogging problems associated with standard sampling techniques. The probe consists of an elongated stainless steel sampling tube having gas intake holes along one side and partially surrounded by a double-walled carbon steel sheath. When the probe is inserted in the gas main from which samples are to be taken, the openings in the tube generally face upstream, the sheath protecting them from direct exposure to the gas stream. Gases entering the sheath are usually heated by the sheath to keep materials they deposited on the sheath wall in a molten state and to prevent condensation of material on the inside walls of the tube. Once inside the probe, tube gases are carried to an appropriate gas switching system and analyzer. When conditions warrant, the sheath can be cooled, rather than heated. In such cases, Freon or another refrigerant may be used.

4697 APTIC NUMBER 14299

Vijan, Prem N.
RAPID COMBUSTION METHOD FOR DETERMINATION OF SULFUR IN LEAD DIOXIDE CANDLES EXPOSED TO ATMOSPHERIC POLLUTION. Environ. Sci. Technol., 3(10):931-934, Oct. 1969. 11 refs.

Lead dioxide candles are widely used for measuring sulfurous contaminants in the atmosphere. The conventional gravimetric procedure for analyzing the sulfur content in exposed candles is time-consuming and exacting. In the present method, the sulfur-bearing material is stripped from the candle, dry ashed, pulped, and weighed. A weighed portion is burned in oxygen atmosphere in an induction furnace and sulfur dioxide liberated is titrated iodometrically. The attractive feature of the method is dry ashing, which destroys the active ingredient, lead dioxide, and eliminates any possibility of sulfur contamination from the laboratory atmosphere. It also eliminates the time-consuming procedures like extractions, filtrations, ion exchange, evaporations, and pH adjustments. Burning the sample in a high-frequency induction furnace offers the obvious advantage of speed. One candle requires 30 min to analyze. The average yield of ash per candle is about 7.5 g. One gram is normally used for analysis, leaving enough for storage and rechecking. If desired, the exposure period of the candles can be considerably shortened because the method is particularly suitable for the determination of low sulfur values. Data are presented to show the close agreement of results obtained by the proposed method and the gravimetric method on duplicate field candles. The precision and accuracy of the method were tested on simulated lead dioxide candles.

4698 APTIC NUMBER 14038

Walker, D. R.

MISCONCEPTIONS ABOUT AUTOMATIC COUNTERS. Contam. Control, 8(9):15-21, Sept. 1969. 8 refs.

Four common misconceptions which quality control technicians often have about automatic particle counters, used for monitoring particles in liquids and gases, are presented and discussed. (1) 'A fluid sample must be representative of the system fluid from which it was sampled.' The results of a repeat analysis from the same system may differ from the first by as much as 300%. The reasons for this are discussed in some detail, including the non-homogeneity of a fluid system and the influence on results of sampling analysis techniques; on-stream analyses produce more representative data than tap sampling into bottles. Variations in automatic classification of particles by size, another complicating factor, are considered, (2) 'Microscope counts should agree with automatic particle counts, automatic particle counts should agree with each other, and if two counts do not agree, one has to be wrong.' The influence of particle shape on difference in size measurement is discussed, especially as the shape deviates from the spherical, to explain the occurrence of such discrepancies. (3) 'Automatic particle counters can solve all contamination monitoring problems.' Automatic counters will probably never replace older techniques for some applications, for example, where such liquid properties as opaqueness, chemical instability, electrical conductivity, and volatility are involved; also some contaminants, such as fibers and flakes, have properties which make them difficult to size. Excessive claims by manufacturers and proof of calibration are additional problems. A 14-point demonstration-of-performance checklist, drawn up by an ASTM committee, is presented. (4) 'Automatic particle counters are not worth the investment.' On-line sampling, filtering efficiency tests on hydraulic filters, sampling of small recirculating liquid systems, and evaluation of bottle samples of liquid are given as some added applications of counters besides the more conventional ones. These instruments can also significantly reduce the cost of certain contamination analyses.

4699 APTIC NUMBER 14301

Wallcave, Lawrence
GAS CHROMATOGRAPHIC ANALYSIS OF POLYCYCLIC AROMATIC HYDROCARBONS IN SOOT SAMPLES. Environ. Sci. Technol., 3(10): 948, Oct. 1969. 3 refs.

An unknown pyrene derivative was isolated from soot by Long and Chakraborty in 1967. An apparently identical compound isolated by this author from a coal tar pitch is presumed to be cyclopenta(c,d)pyrene (or acepyrene). The absorption spectrum of this substance has the seemingly characteristic peaks found by Long and Chakraborty at 378 and 358 millimicrons. Its molecular weight is 228, and its mass spectrum possesses peaks at m/e values greater than 228. Cyclopenta(c,d)pyrene is the only compound of reasonable structure that can have a molecular weight of 228 as well as the absorption spectrum and chromatographic behavior of an alkyl pyrene derivative. It is by no means a trace element. Five to 10 micrograms were isolated from 5 mg of coal tar pitch, indicating a concentration of 0.1%.

4700 APTIC NUMBER 14135

Warren, Harry V. and Robert E. Delavault
LEAD IN VEGETABLES. Lancet, vol. 1:1252, June 8, 1968. 12 refs.

The study points out the variations in the lead contents of oven-dried vegetable samples collected from various sites in England, Scotland, Wales, and British Columbia. The lead content was summarized in a table. Most of the abnormally high values could be correlated with soils containing large amounts of the metal. The lead in some of these soils was caused by intense industrial pollution. In other areas, there is ample evidence that the lead originates from the parent rocks of which those of Devonian, Carboniferous, and Permian ages are probably the most important. Many of the high-lead samples also came from private gardens, the owners of which are probably exposed to a higher lead intake than they would be if they bought their vegetables from the general markets.

4701 APTIC NUMBER 14170

West, Philip W. and G. C. Gaeke
FIXATION OF SULFUR DIOXIDE AS DISULFITOMERCURATE(II) AND SUBSEQUENT COLORIMETRIC ESTIMATION. Anal. Chem., 28(12):1816-1819, Dec. 1956. 8 refs.

An attempt was made to find an absorbing system for sulfur dioxide which was efficient and formed a stable compound and, in addition, to make an improvement in the sulfuric acid-bleached fuchsin reagent. Solutions of mercury(II) salts as absorbers of SO2 were investigated. Because mercury(II) forms complexes easily with chloride, it was decided to determine the stability of the complex in solutions of various chloride strengths. Sulfur dioxide in the atmosphere was removed and concentrated by scrubbing with 0.1M sodium tetrachloromercurate(II). Stable, nonvolatile disulfitomercurate(II) was formed. It was shown from data that tetrachloromercurate(II) was an efficient scrubber for SO2 even at high flow rates, because no SO2 escapes from the first scrubber. The subsequent determination of the isolated SO2 was based on the red-violet color produced when p-rosaniline hydrochloride hydrochloric acid mixture and formaldehyde are added to the sampling solution. The absorption maximum is at 560 millimicrons and the color is temperature-independent for several hours. Nitrogen dioxide was the only interference with this method, but sulfide interference associated with the reagent could occur. This method was sensitive (about 0.005 to 0.2 ppm), reproducible, and accurate, and should be useful in the absolute determination of sulfur dioxide in air pollution surveys.

4702 APTIC NUMBER 14108

Wilby, Frank V.
VARIATION IN RECOGNITION ODOR THRESHOLD OF A PANEL. Preprint, Air Pollution Control Assoc., Pittsburgh, 17p., 1968. 6 refs. (Presented at the 61st Annual Meeting of the Air Pollution Control Assoc., St. Paul, Minn., June 23-27, 1968, Paper 68-16.)

Measurement Methods

Recognition odor thresholds of an untrained panel of 35 people were determined for several mercaptans, organic sulfides, di- and trisulfides, and hydrogen sulfide, a total of 18 compounds. This was part of a study to correlate the odor strength of natural gas with its sulfur analysis. The panel was selected to approximate the age and sex distribution of the adult U. S. population. Other than to exclude anosmics, olfactory acuity was not a factor in selecting the panel. For each test of each odor, a hundred-fold range of concentration was presented to the panel in eleven increments of the fifth root of ten. A concentration of zero was also included. The range of concentrations was selected so as to present concentrations above and below the olfactory thresholds of all panelists. Data are presented on the variations in odor threshold of individuals at different times to the same compound, and of the panel to each of a series of 18 compounds. An attempt also was made to identify anomalous olfactory responses of specific individuals to specific compounds. Results of this phase of the study tended to confirm the assumption that in general a person's olfactory sensitivity is fairly constant, and indicated that odor threshold anomalies do exist, however, more data is required before they can be measured accurately.

4703 APTIC NUMBER 14148

Bourbon, P. in collaboration with J. Bramel, P. Dorbes, and J. Laborie
CONTRIBUTION TO THE STUDY OF ATMOSPHERIC POLLUTION: A) IN THE CARMAUX REGION; B) IN TOULOUSE. (Contribution a l'etude de la pollution atmospherique. A) Dans la region de Carmaux; B) A Toulouse). Text in French. Pollut. Atmos. (Paris), 11(41): 23-33, Jan./March 1969.

The results of air quality measurements carried out for several years are reported for the Carmaux region, while a preliminary investigation of atmospheric pollution is reported for Toulouse. In the Carmaux region, pollution originates in discharges from a coke plant and a factory manufacturing nitrate fertilizers. For this reason, variations in the rate of sulfur derivatives, expressed as SO2, and nitro derivatives, expressed as NO2, were investigated. The presence of H2S was confirmed on several occasions. Results show that pollution is limited geographically. The high acidity found at various points in Toulouse was established by the oxygenated water method, the West and Gaeke method, and the zinc acetate method. Sulfur dioxide measurements show that pollution from this compound is limited in winter and almost nonexistent in summer.

4704 APTIC NUMBER 13964

Detrie, J. P.
METEOROLOGICAL CONDITIONS AND ATMOSPHERIC POLLUTION IN THE PARIS AREA. (Conditions meteorologiques et pollution atmospherique dans la region parisienne). Text in French. Meteorologie, no.2: 273-293, April-June 1967.

The evolution of sulfur dioxide in Paris and its environs is being determined by daily measurements made by the Laboratory of Hygiene. This sulfur dioxide is almost entirely the product of combustible solids and liquids; the amount of pollution due to motor oils and gases is small and consists of nitrogen oxides. Where chimneys open at rooftop level, the velocity of exit gas temperatures is not an important factor in the dispersion of emissions. Dispersion due to vertical drop in temperature and the albedo (reflective power) of the city is important, ensuring good atmospheric diffusion of pollutants even when winds are weak. Calm periods, with an inversion of temperature, hinder dispersion of emissions and cause an important increase in contamination. Strong winds reduce the concentration of contaminated air. The maximum number of pollutants appear in winds from the northeast or southeast. Winds from the west carry few pollutants. The strongest pollution corresponds to the anticyclone barometric pressures. Rain reduces pollution but coincides with winds from the west. Beginning with arrondissements with 3,000 occupants per sq km, a good correlation exists between population density and pollution. Below this figure, pollution is independent of population density.

4705 APTIC NUMBER 14180

Gordon, Robert J., Henry Mayrsohn, and Raymond M. Ingels
C2-C5 HYDROCARBONS IN THE LOS ANGELES ATMOSPHERE. Environ. Sci. Technol., 2(12):1117-1120, Dec. 1968. 12 refs.

A joint study was carried out in Los Angeles in the fall of 1967 to define more closely the actual concentration of oxides of nitrogen and various hydrocarbons in the atmosphere on days of differing smog intensity. Part of the study involved gas chromatographic analysis for light hydrocarbons, ethane to isopentane, at two sites. Almost 700 samples were run during 46 days. Averages were presented for the hourly samples subdivided into groups of high or low oxidant development. Light paraffins, especially propane, were found in concentrations too high to be ascribed to auto exhaust, but their source was not pinpointed. The average morning concentration of oxidant at various locations was closely similar, hour by hour, in spite of large differences in the levels of primary pollutants. The ratios of acetylene and high olefins to nitrogen oxides were found to be higher than the average in exhaust generated in a test cycle on a dynamometer.

4706 APTIC NUMBER 14276

Kemeny, Etel and E. C. Halliday
CONCENTRATIONS OF SULPHUR DIOXIDE IN SOUTH AFRICAN CITIES AND TOWNS. DATA FOR OCTOBER, 1958 TO SEPTEMBER, 1968. Council for Scientific and Industrial Research, Pretoria (South Africa), Air Pollution Research Group, CSIR SR-SMOG 4, 26p., 1969. 4 refs.

Results of measurements of sulfur dioxide concentrations from Oct. 1958 to Sept. 1968 in six South African cities are presented in annual tables: the cities are Cape Town, Durban, East London, Johannesburg, Germiston, and Pretoria. Measurements were made by the hydrogen peroxide method, which consists of drawing a measured volume of air through a gas wash-bottle in which a dilute solution of hydrogen peroxide absorbs the atmospheric sulfur dioxide and oxidizes it to sulfuric acid. After a predetermined interval, the solution is taken to the laboratory and its sulfuric acid content is determined by titration carried out to an end point of pH 4.5 to eliminate interference from atmospheric carbon monoxide. Using this method, SO2 concentrations were measured continuously for sampling periods of two to three days. Data are expressed in micrograms per cubic meter, and have been calculated to show monthly, seasonal, and annual average concentrations of SO2, as well as peak monthly concentrations and percentage frequencies of concentrations above specified limits. (Organizations involved in the sampling and analysis work included the National Physical Research Laboratory and the Air Pollution Research Group in Pretoria.)

ATMOSPHERIC INTERACTION

4707 APTIC NUMBER 14019

Altshuller, A. P.
COMPOSITION AND REACTIONS OF POLLUTANTS IN COMMUNITY ATMOSPHERES. Bull. World Health Organ. (Geneva), 40(4):616-623, 1969. 26 refs.

Data are presented showing the composition of gaseous and particulate substances in community atmospheres, based on measurements in various cities in the United States. Many of the pollutants react further, usually to produce substances as undesirable as the original ones, or more so; most of these reactions involve thermal oxidation or photooxidation. Because of the importance of considering air pollution on a regional or even continental scale, a general framework of residence times of pollutants is postulated: up to several days under adverse conditions in many regions, but less than 24 hours across large urban areas under more usual conditions of wind speed and movements of weather fronts. Pollutants and other atmospheric substances are categorized as either reactants-those substances emitted directly into the atmosphere from combustion, industrial, and biosphere processes; or products such as nitrogen dioxide and sulfates. Some substances may fall into both groupings. Data are given on rates of various reactions, and the nature of the products is described. In general, the measurements showed 1% to 15% conversions of gaseous to particulate species on a long-term basis; rates of conversion of nitrogen dioxide to nitrate were consistently lower than those of sulfur dioxide to sulfate. Recent work on particle size distributions of various metallic and non-metallic ions in particulates in U. S. cities is reviewed, with data given in terms of mass median diameters. It is pointed out that the biosphere is a source of, as well as a sink for, pollutants, and that urban levels of methane or nitrous oxide, for example, reflect to a considerable extent biosphere, rather than urban, emissions. Reactions originating in biosphere processes may contribute significantly to regional pollution, particularly during periods of stagnation. The need for increased emphasis on atmospheric investigations, as opposed to laboratory work, and for improved sensitivity and specificity in monitoring and sampling is discussed.

4708 APTIC NUMBER 14291

Charlson, R. J.
ATMOSPHERIC VISIBILITY RELATED TO AEROSOL MASS CONCENTRATION. A REVIEW. Environ. Sci. Technol., 3(10):913-918, Oct. 1969. 46 refs.

The often severe reduction in visibility that occurs due to the presence of particles in polluted air is a function of the relationship between the visual properties of air and the aerosol characteristics, particularly mass concentration; the present knowledge of this relationship is summarized in basically mathematical terms. An approximate proportionality between the mass concentration of atmospheric aerosol of relative humidity less than about 70% and the extinction coefficient due to light scattering has been widely demonstrated and is of particular practical importance. The significance to this relationship of the concept that aerosol size distribution always has the same form or shape is reviewed. The development of an integrating nephelometer of sufficient sensitivity and stability for long-term studies of the atmosphere has made possible new experimental approaches to the problem, primarily the correlating of the mass concentration of aerosol to the extinction coefficient due to scatter and an explanation of observed variations in the mass-concentration-light-scattering proportionality. Light scattering and extinction as related to aerosol characteristics are discussed in terms of the absorption of light by gases, which is well understood, and light absorption by aerosols, which to date has not been accurately measured. The variables that control mass concentration, and their effects on visual range, are reviewed. The possible applications of present knowledge to the study of trends and effects of air pollution are discussed. Of 238 cases measured with an integrating nephelometer, 90% had a mass concentration-visual range product of 1.8 plus 1.8 or minus 0.9 grams per sq m. It is concluded that, although this represents a factor of only 2 in terms of accuracy, application to such problems as air quality standards is possible, and that in view of the scarcity of such relationships or of better accuracy, this application seems valid.

4709 APTIC NUMBER 13992

Fischer, G. and H. Brantner
STUDIES ON THE SIGNIFICANCE OF AIR POLLUTANTS TO THE GRAZ DISTRICT. I. THE RELATIONSHIPS BETWEEN AIR POLLUTION, GEOGRAPHIC AND CLIMATOLOGIC CONDITIONS. (Studien ueber die Bedeutung von Luftverunreinigungen fuer den Raum Graz. I. Mitteilung: Die Zusammenhaenge zwischen Luftverunreinigung, geographischen bzw. klimatologischen Verhaeltnissen). Text in German. Arch. Hyg. Bakteriol. (Munich), 152(5-6): 385-392, Dec. 1968. 6 refs.

The orographic location of the city of Graz, Austria, is described in detail and is shown to be the dominant factor determining the meteorological conditions in the Graz district. High mountain ranges forming the northern and western borders of the Graz plain attenuate the severity of temperature and moisture changes of air masses moving in from the North and the West. The hills bordering this plain on the South leave it somewhat exposed to the influence of low-pressure regions originating in the gulf of Genoa in the Mediterranean and moving eastward towards Hungary and, ultimately, northward into the Baltic region. The resulting local meteorological conditions are described in much detail with special emphasis on the high incidence of calm days and prolonged temperature inversions. In all, these conditions are conducive to progressive SO2 enrichment of the air in various parts of the Graz district, the adverse effects of which may sometimes be aggravated by the simultaneous presence of dust, soot, fog, or other contaminants. Sulfur dioxide contained in the flue gases of domestic and industrial furnaces is the principal air pollutant in that district. The authors recommend that new industrial installations be confined to certain meteorologically acceptable regions of the district and be equipped with effective flue gas cleaners. Frequent measurements of the SO2 content of air by an extensive close-mesh network of sampling stations carried out

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throughout the year and the correlation of their results with concomitant local meteorological data are prerequisite for obtaining and adequate rational basis of an effective control of air pollution in the Graz district.

4710 APTIC NUMBER 12164

Herkhof, Dirk and Aksel Wiin-Nielsen
OBSERVED TEMPERATURE PROFILES NEAR THE LAKE MICHIGAN SHORELINE. Michigan Univ., Ann Arbor, Dept. of Meteorology and Oceanography, Office of Research Administration Proj. 08650, Rept. 08650-3T, 37p., Jan. 1969. ((9)) refs.

A temperature measurement program using a thermistor sensor and a continuous recording device on an automobilt was carried out near the shore of Lake Michigan south of Grand Haven, Michigan, on several favorable days in the summer of 1967. This study provided a detailed illustration of the temperature distribution along a line perpendicular to the shore on mostly sunny days and under different prevailing wind situations. Of the four days during which good data were obtained, one had a prevailing moderate westerly wind, another a prevailing easterly wind with a lake breeze gradually pushing inland from the west. On the two other days light southerly to southwesterly wind prevailed. A description of the instruments used and a brief account of the operational procedures are given. The temperatures have been plotted as a function of distance inland at various times of the day together with the winds recorded at different distances from the shore. (Authors' abstract, modified)##

4711 APTIC NUMBER 12165

E.Y.H. Keng, C.C. Wellons, C. Orr, Jr.
HYSTERESIS IN SMOG AND FOG DISAPPEARANCE (FINAL TECHNICAL REPORT.) Georgia Inst. of Tech., Atlanta, Engineering Experiment Station, Proj. B-330, 63p., Feb. 1969. 26 refs.

The behavior of sodium chloride aerosol particulates under various humidity conditions was investigated. The effects of foreign vapors such as methylamine and sulfur dioxide were studied. A small quantity of methylamine in the aerosol was found to promote condensation on the sodium chloride particulates when the relative humidity was increased and was found to retard evaporation of sodium chloride solution droplets when the relative humidity was decreased. This is because the dew point temperature of the aerosol is increased by the presence of the methylamine. Sodium chloride crystals at a room temperature of 75 degrees F will dissolve into droplets when the dew point temperature of the methylamine-free aerosol is above 66.5 degrees F. This would not occur until the dew point of the aerosol was above 70.5 degrees F when the aerosol contained only 0.1 per cent methylamine by volume. This is because the solubility and the dissolution rate of sodium chloride are retarded by the presence methylamine in condensed water. Evaporation of sodium chloried solution droplets in air containing sulfur dioxide seemed to be slower than in air alone when the concentration was high. No difference was detected on the growth of dry crystals, however. Ethanol vapor and Alpha-pinene did not affect either evaporation or growth for the conditions tested. Aerosols generated from sea water behaved similarly to those generated from sodium chloride solutions. (Authors' summary)##

4712 APTIC NUMBER 14015

Mueller, W.
INFLUENCE OF DIFFERENT METEOROLOGICAL CONDITIONS ON THE CONCENTRATION OF FREEZING NUCLEI. (Ueber den Einfluss meteorologischer Bedingungen auf die Gefrierkerndichte der Luft). Text in German. Arch. Meteorol. Geophys. Bioklimatol. Ser. A (Vienna), 18(1-2):55-74, 1969. 14 refs.

The daily concentration of freezing nuclei has been measured three times a day in Austria since 1963. The results from three stations are presented: Vienna (170 m above sea level (a. s. l.)), a city station situated in the center of an urban and industrialized conglomeration, Villacher Alpe (2140 m a. s. l.), a mountain station which is an isolated peak in the Eastern Alps without any sources of artificial nuclei, and Obersiebenbrunn (150 m a. s. l.), a country station. A survey is presented of the annual variation, mean values, relative frequency distribution, and the anomalies of the concentration of ice nuclei. The influence of air masses, fronts, precipitations, and fog on the concentration of the freezing nuclei is discussed. Also the results of some experiments with artificial nuclei are communicated. Finally an attempt was made to establish a criterion based on the obtained results as a tool for a short-range precipitation forecast. (Author summary modified)

4713 APTIC NUMBER 14041

Nagy, A.
VERTICAL PROFILE OF THE CONCENTRATION OF LARGE AND GIANT ATMOSPHERIC PARTICLES. Idojaras (Budapest), 73(1):12-21, Jan.-Feb. 1969. 16 refs.

This research was directed mainly to the investigation of the processes of atmospheric condensation and the formation of fog and clouds. Measurements made by the aircraft were extended to upper layers of the atmosphere where clouds are formed. The aim of the flights consisted of determining the vertical distribution of aerosol particles in the lower atmosphere. A total of 23 measurements were made and distributed seasonally. All flights were made at approximately the same time of day. Because of the differences between summer and winter thermal stratification, data was separated for both seasons for determining the vertical profile of concentration. Results showed a strong winter concentration peak at ground level which extended only to a very shallow layer of the atmosphere. In the summer, the lower atmosphere contained 2.5 times more particles than in winter. The influence of the coagulation of particles may be neglected for both particle sizes. In the case of particles of 0.5 micron radius, sedimentation does not yet play an important role, and in addition to the effect of eddy diffusion, only the washout effect is of importance. In the case of particles of 4.0 micron radius, sedimentation exerts a strong influence on the vertical distribution in addition to washout. It appeared from the data that the value of the coefficient of eddy diffusion, which determines the vertical transfer of different physical quantities, varies with altitude. This was explained in terms of the thermal stratification of the atmosphere. It appeared from the data that the variation of size distribution of the large particles with altitude did not agree with theory.

4714 APTIC NUMBER 13965

Parczewski, Wladyslaw
INFLUENCE OF THE STABILITY OF ATMOSPHERE ON THE CONCENTRATION OF AIR POLLUTANTS. (Einfluss der Stabilitaet der Atmosphaere auf die Konzentration der Luftverunreinigungen). Text in German. Z. Meteorol., 20(1-6):99-100, 1968.

Continuous measurements were made of the SO2 content of air near the ground by means of an EEL SO2 meter mounted on a vehicle in the vicinity of the 120 meter-high smoke stack of the Skawina (Poland) power plant at different types of stability of layering and at different wind speeds. The same type of measurements were also made at the distance of 1 kilometer from the Turoszow power plant. The results show sharp quasi-periodic fluctuations of the SO2 content between 0.3 and 0.8 mg/cu m under labile layering conditions. At stable layering, its fluctuations are much smaller and its mean value decreases with increasing wind speed. The type of SO2-content fluctuations is well correlated with the type of layering of the atmosphere, so that knowledge of either one will enable inferences to be made regarding the other.

4715 APTIC NUMBER 14044

Reidat, R.
DAILY VARIATION OF TEMPERATURE AT ALTITUDES OF UP TO 200 METERS AND ITS INFLUENCE ON THE DISTRIBUTIONS OF FLUE GASES ACCORDING TO AIR TEMPERATURE RECORDS AT THE LOWER ELBE RIVER NEAR STADE. (Ueber den taeglichen Gang der Lufttemperatur bis in 200 m Hoehe und sein Einfluss auf die Verbreitungen von Rauchgasen nach Registrierung der Lufttemperatur an der Unterelbe bei Stade). Text in German. Z. Meteorol., 20(9-10):310-317, 1968. 3 refs.

At the smoke stack of the Schilling power plant near Stade, Germany, air temperatures were recorded at ten altitudes between 2 and 200 meters. These records provide a means for studying temperature variation with altitude. On the basis of records made during the summer, the build-up of the nocturnal ground inversion can be studied. After sunrise, it disperses from the ground upwards. The course of this dispersion and its effect on the spreading of flue gases are followed. A few hours before sunset, a stabilization sets in at the high altitude and can first be observed when the good-weather cumulus clouds begin to dissolve. The course of this stabilization at the altitudes below 200 meters is estimated on the basis of changes of the temperature gradient at the various altitudes. After sundown and at the start of the negative radiation balance, there is again a build-up of the inversion from the ground upwards, while at the high altitudes, a temperature decrease continues for some time.

4716 APTIC NUMBER 14032

Slade, David H.
LOW TURBULENCE FLOW IN THE PLANETARY BOUNDARY LAYER AND ITS RELATION TO CERTAIN AIR POLLUTION PROBLEMS. J. Appl. Meteorol., 8(4):514-522, Aug. 1969. 12 refs.

Evidence for the existence of almost smooth wind flow above a height of several hundred feet is cited; during smooth flow conditions, both wind speed and direction traces show such low levels of turbulence that the term 'laminar' is sometimes associated with them. Spatial and temporal variations of this phenomenon were analyzed on the basis of a survey of approximately 100,000 hours of analog wind speed and direction charts from various heights on 12 tall towers located at various sites in the middle and eastern parts of the United States; data were all obtained from Bendix Friez Aerovane sensors. An effort to correlate the average number of hours of smooth plus restricted-turbulent (SR) type of flow gave sufficient agreement at some sites to suggest that the frequency of SR flow may be a sensitive index to the general levels of boundary layer diffusive intensity; the Thanksgiving 1966 East Coast high air pollution episode appeared in the November 1966 data as a major peak both in pollution concentration and number of hours of SR flow. The existence of elevated layers of very low turbulence is suggested to be of direct and major importance in the evaluation of diffusion in any situation in which a pollutant is released within or diffuses up to such a layer from tall stacks. A smoke plume released into smooth flow will travel downstream spreading only slowly in the horizontal and even less in the vertical. These plumes pose a potential hazard at great distances if a mechanism exists which suddenly brings the elevated material to the ground. On the positive side, the smooth flow condition will prevent the plume from immediately diffusing toward the ground with resulting high concentrations.

4717 APTIC NUMBER 14016

Sladkovic, R.
AN INVESTIGATION OF THE TRANSPORT OF FALLOUT FROM THE SEVENTH CHINESE NUCLEAR EXPLOSION INTO THE ALPS. (Untersuchung ueber den Transport des Fallout von der seibenten chinesischen Kernwaffenexplosion in den Alpenraum). Text in German. Arch. Meteorol. Geophys. Bioklimatol. Ser. A (Vienna), 18(1-2):87-110, 1969. 54 refs.

The first wave of artificial radioactivity from the seventh Chinese nuclear explosion of December 24, 1967 was detected at the three mountain sites Zugspitze (2963 m), Wank (1780 m), and Garmisch-Partenkirchen (735 m). Unexpectedly, it arrived at the Zugspitze station on the seventh day after the test and 12 hours later at the valley station of Garmisch-Partenkirchen. This implies that conditions for fallout transport and downward tropopause penetration must have been exceptionally favorable in the region surrounding the stations. A meteorological study disclosed the fact that the radioactive material had been moved from the explosion site by a relatively strong jet stream. It was also found that the fission products were carried downward into the troposphere by high-level subsidence in the eastern Atlantic Ocean during the period from noon, December 29, 1967, to midnight, December 30. Isentropic trajectories were computed leading backward from the Zugspitze peak from December 29 to 31, 1967. It was found that the airflow originated in the eastern Atlantic Ocean subsidence region. Computations of potential vorticity revealed the stratospheric origin of the air mass marked by the fresh fallout. (Author summary modified)

4718 APTIC NUMBER 13984

Walsh, John D. and Morton I. Goldman
METEOROLOGICAL FACTORS IN REACTOR SITING. Preprint, American Nuclear Society, 10p., 1967. 9 refs. (Presented at the Winter Meeting of the American Nuclear Society, Chicago, Nov. 5-9, 1967.)

In assessing meteorological conditions at nuclear power plant sites, three primary factors must be evaluated: an initial conservative estimate of weather extremes as a consideration in plant design; a determination of average site dispersion conditions that will affect the planning of the release and distribution of waste gases; and consideration of atmospheric conditions that might prevail during an accidental release of fission products. Meteorological data are generally available for locations not too distant from a potential reactor site. Although the data are often not in a form applicable to use in nuclear plant siting, techniques are available for deriving and applying a diffusion climatology from these data to the reactor site. In view of this, the extremely conservative meteorological assumptions that are often used in current practice are judged to be generally unwarranted. Usually data from two or more nearby stations are employed. After the data are reduced, they must be examined carefully for application to the reactor site. This usually requires a comparison of local topography at the data source and at the proposed site, including differences in hill heights, valley orientations, land-water relationships, and the land surface characteristics. By selection of a nearby observation station having a preponderance of topographic characteristics similar to the proposed site, it is usually possible to make a reasonable judgement of the climatology to be expected at this site. Examples are given for the cases of nuclear reactors at Threemile Island in the Susquehanna River Valley, and at the Zion site in the Lake Michigan area, where Milwaukee data was used.

4719 APTIC NUMBER 13999

Angell, C. A.
DIFFUSION-CONDUCTANCE RELATIONS AND FREE VOLUME IN MOLTEN SALTS.
J. Phys. Chem., 69(2):399-403, Feb. 1965. 24 refs.

Departures from the Nernst-Einstein equation for a variety of pure molten salts are correlated by means of 'glass transition-based' corresponding temperatures suggested by a recent free volume model of transport in molten salts. Coupled with molar volume data, these correlations are consistent with the view that mutual ionic interference, rather than paired vacancy diffusion, causes the breakdown of the Nernst-Einstein equation in these liquids. (Author abstract)

4720 APTIC NUMBER 13152

Angell, C. A.
ELECTRICAL CONDUCTANCE OF CONCENTRATED AQUEOUS SOLUTIONS AND MOLTEN SALTS: CORRELATION THROUGH FREE VOLUME TRANSPORT MODEL.
J. Phys. Chem., 69(6):2137, June 1965. 10 refs.

The possibility of extending a free volume transport model to concentrated aqueous solutions was investigated by measuring the electrical conductance of $Mg(NO_3)_2$-H_2O solutions as a function of temperature and water content within a defined range, and of molten $Ca(NO_3)_2 \cdot 4H_2O$ as a function of temperature. The To (theoretical glass transition temperatures) values obtained were dependent on the charge concentration. The conclusion that To values for the 1:4 liquids could be predicted within experimental error by methods described is emphasized. Evidence indicated that both the electrical conductance behavior and the glass-forming ability of these solutions may best be interpreted by regarding the aqueous melts as molten salts of large (i.e. weak field) cations. The free volume approach is considered to offer an interpretation of both the temperature dependence of liquid transport properties and the phenomenon of glass formation and may provide a useful new view of concentrated electrolyte solutions in general.

4721 APTIC NUMBER 14228

Angell, C. A.
FREE VOLUME MODEL FOR TRANSPORT IN FUSED SALTS: ELECTRICAL CONDUCTANCE IN GLASS-FORMING NITRATE MELTS. J. Phys. Chem., 68(7):1917-1929, July 1964. 35 refs.

A free volume model for transport in fused salts was tested by electrical conductance measurements on $Ca(NO_3)_2$ plus KNO_3 melts. To analyze the temperature diffusion on the basis of the model, the temperature dependence of conductance was corrected to correspond to that for a diffusion process. Results during any temperature vs conductance run were strikingly consistent and show that departures from linearity increase as the liquidus temperature falls. This was especially notable for 31.8 and 45.0% $Ca(NO_3)_2$ melts, which failed to crystallize. Specific conductance isotherms for the system suggest that the glass-forming ability of the melts is not explained in terms of structural abnormalities. The conventional activation energies calculated for specific conductance show rapid and striking increases at the lower temperatures. The temperature for zero free volume in the liquid can only be established precisely for salts which do not crystallize, and the relationship between this temperature and composition is linear within the uncertainty of determination. This factor is capable of accounting quantitatively for the special temperature dependence of the transport observed and its identification with zero-point temperature of the free volume concept of glass formation. It is suggested9that the term 'activation energy' is more appropriately applied to the distribution of the total free volume among the different ionic species, since the latter factor is temperature-independent in the low temperature region.

4722 APTIC NUMBER 14086

Angell, C. A.
SUCCESS OF FREE VOLUME MODEL FOR TRANSPORT IN FUSED SALTS. J. Phys. Chem. 68(1):218-220, Jan. 1964. 4 refs.

Compositional independence is reported for electrical conductance behavior of $Ca(NO_3)_2$ plus KNO_3 melts, as revealed during a test of Cohen and Turnbull's free volume model for transport in fused salts. To obtain the necessary precision, conductance measurements were made and the temperature coefficients were corrected to those for a diffusion process. It was concluded that the free volume model correctly describes transport in molten nitrates without restriction to glass-forming mixtures. Since the mean coefficient of expansion varies less than 2% over the composition range, it was concluded that the void volume:ion volume ratio involved in transport is about the same for all ions regardless of size or charge. Since the 'mean cationic potential' of the melt increases linearly with the $Ca(NO_3)_2$ concentration, it follows that the zero point for free volume in these melts is directly proportional to the mean ionic field strength of the melt.

4723 APTIC NUMBER 13978

Angelova, G., L. Lazarov, and V. Kovaceva
BEHAVIOR OF SULFUR COMPOUNDS IN COAL DURING TREATMENT WITH SODIUM IN AN AMMONIACAL SOLUTION. (Ueber das Verhalten der Schwefelverbindungen in der kohle bei deren Behandlung mit Natrium in ammoniakalischer Loesung). Text in German.
Brennstoff-Chem. (Essen), 50(1):11-14, Jan. 1969. 26 refs.

Coal samples with different S contents and of different degrees of carbonization were treated with sodium in an ammoniacal solution at -35 C. In this process, a decomposition of the pyrite and a rupture of C-S-C bonds in the organic constituent occur with formation of mercaptans, sodium sulfide, and hydrogen sulfide. While the sulfide and disulfide bonds are readily broken, heterocyclic bonds are not. The above-mentioned treatment of coal provides a deeper insight into the nature of the organically-bound S and leads to the realization that in the cokable and sulfur-rich coals, the share of the rupturable C-S-C bonds is considerable, whereas in the less carbonized, non-cokable coals, it is quite small. The behavior of the S-bonds during this treatment is compared with that of the O-bonds.

4724 APTIC NUMBER 14307

Baker, E. H.
THE STRONTIUM OXIDE-CARBON DIOXIDE SYSTEM IN THE PRESSURE RANGE 0.3-400 ATMOSPHERES. J. Chem. Soc., 1963:339-346, Jan.-Feb. 1963. 5 refs.

The strontium oxide-carbon dioxide system was studied at carbon dioxide pressures up to 400 atm by using pressure vessels with internal heating arrangements. For the reaction SrCO3 yields SrO plus CO2 in the temperature range 1149-1259 deg, the eutectic point was estimated to lie at 1270 deg and 1.12 atm. Above 1270 deg and 1.12 atm, dissociation of strontium carbonate is accompanied by fusion of the resultant oxide with unchanged carbonate to form melts. The reason for this is not clear. It may be fusion below the equilibrium temperature or decomposition of the solid preceding fusion, whereby a very small amount of oxide is retained in solid solution. Above the eutectic point, the pressure-temperature relationship was plotted for the binary melts in equilibrium with solid phases. By means of thermogravimetric and quenching techniques, the temperature-composition relationship was derived for the eutectic portion of the system. The eutectic composition was found to be 79.3 mole % SrCO3 and 20.7 mole % SrO. (Author abstract modified)

4725 APTIC NUMBER 14209

Bear, I. J.
FURTHER OBSERVATIONS ON THE OCCURRENCE OF METASTABLE PHASES DURING THERMAL DECOMPOSITION OF SULPHATES. Australian J. Chem., 21(1):21-36, 1968. 17 refs.

Observations of the occurrence of metastable phases in the BeSO4-H2O system substantiated earlier findings relating to the Zr(SO4)2-H2O system. The results provided further evidence that the formation of polymorphic compounds during thermal decomposition processes is controlled by the vapor pressure of the volatile component in the relevant region of the particular phase system. Metastable forms of BeSO4.2H2O and BeSO4.H2O may be observed during thermal decomposition of BeSO4.4H2O, their occurrence depending on the partial water vapor pressure in the immediate environment of the sample during decomposition. When the decomposition takes place in air at low external vapor pressure, their formation is influenced by any factors which affect the self-generated partial water vapor pressure. The vapor pressure existence range of metastable BeSO4.2H2O was investigated. Anomalous effects observed when sulfuric acid solutions were used to provide fixed water vapor pressures during hydration and equilibration studies are attributed to the influence of the very low partial pressures of SO3 (or H2SO4) over these solutions. The X-ray powder diffraction patterns of the equilibrium BeSO4.2H2O and BeSO4.H2O phases were indexed. (Author summary modified)

4726 APTIC NUMBER 14096

Bertozzi, G. and G. Soldani
SURFACE TENSION OF MOLTEN SALTS. ALKALI SULFATE AND CHLORIDE-SULFATE BINARY SYSTEMS. J. Phys. Chem., 71(5):1536-1538, April 1967. 10 refs.

The surface tension of binary mixtures of ionic liquids was investigated for the purpose of providing a set of previously unknown numerical data and to determine whether the surface behavior of these systems parallels that of other alkali metal salts. The 'Wilhemy slide' method was altered for pure molten alkali sulfates and the solutions of alkali sulfates in their corresponding chlorides. The surface tension of all the liquids showed a linear dependence on temperature. The surface tension isotherms for the chloride-sulfate systems are smooth curves which deviate slightly from linearity; this trend seems to be in contrast with the great difference in size, charge, and shape between the Cl(-) and SO4(2-) anions. On the other hand, investigations of the phase diagrams of the systems Na2SO4-NaCl and Na2SO4-NaBr indicate that the thermodynamic properties of these mixtures are very close to ideal. The deviations from linearity shown by the surface tension isotherms of the alkali sulfate systems are more or less large, following the difference in size of the alkali ions in the mixture. The values for the ratio of maximum deviation to the parameter for the various binary systems are scattered in a large range. A crude correlation could be made with the average lattice energies. Since distortion phenomena change with changing size and polarizing of the ions, the strict relation of bulk to surface properties was not feasible.

4727 APTIC NUMBER 14043

Bischoff, Friedrich
KINETICS OF THE THERMAL DISSOCIATION OF DOLOMITE AND LIMESTONE IN DIFFERENT GAS STREAMS. (Ueber die Kinetik der thermischen Dissoziation von Dolomit und Kalkstein in verschiedenen Gasstroemen). Text in German. Z. Anorg. Chem., 262(5):288-296, May 1950. 25 refs.

The selective effects of humid air, steam, and carbon dioxide on the dissociation of three samples of dolomite and one sample of limestone at 550, 600, 650, 700, 750, and 800 C were determined at a gas volume rate of flow of 4 l/hr for durations of 30, 60, and 120 min. The dissociation rate constants determined from the test results were used to compute the associated temperature increments with the aid of the Arrhenius equation.

4728 APTIC NUMBER 14145

Bjerklie, John and Stephen Luchter
RANKINE CYCLE WORKING FLUID SELECTION AND SPECIFICATION RATIONALE. Preprint, Society of Automotive Engineers Inc., New York, N. Y., 10p., 1969. 14 refs. (Presented at the International

Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690063.)

Present applications of Rankine cycle turboalternators and turbogenerators cover a power range of 2.5 orders of magnitude and extend from unattended microwave repeater stations to marine and automotive installations. Organic working fluids used include dowtherm, dichlorobenzene, toluene, liquid metals, water, monochlorobenzene, perfluorodecalin, and hexafluorobenzene. As more potential applications for the Rankine turbine and reciprocating systems become apparent, a family of new organic fluids suited to quantity applications must be developed. Ideally, these fluids will have high thermal efficiency. The best will be those whose vapor pressures extend across temperature fields without going beyond pressure limts. Alternatives will be fluids requiring low superheat and having the widest temperature difference between peak and minimum pressure. Other requirements are high molecular weight, thermal stability, freezing points below minimum temperature, isentropic saturated vapor lines, and a liquid specific heat of 0.4. Fluids must be compatabile with common construction materials.

4729 APTIC NUMBER 13997

Blander, M., W. R. Grimes, N. V. Smith, and G. M. Watson
SOLUBILITY OF NOBLE GASES IN MOLTEN FLUORIDES. II. IN THE LIF-NAF-KF EUTECTIC MIXTURE. J. Phys. Chem., 63(7):1164-1167, July 1959. 9 refs.

Fused salts offer a radically different solvent medium for the study of gas solubilities. In the present investigation, solubilities of helium, neon, and argon were measured in the eutectic mixture LiF-NaF-KF (46.5:11.5:42.0 mole%) at 600, 700, and 800 deg. The solubilities of the gases, all of which obey Henry's law within plus or minus 5%, increase with increasing temperature and with decreasing molecular weight of the gas. The enthalpies of solution of all the gases are positive and increase in proportion to the atomic radius. The standard entropy change of a solution is purely a function of the properties of the gas in the solvent studied, since the only change of significance is the environment of the gas atoms. The total entropy of solution of the gas is the entropy change for the equilibrium process. A model which equates the free energy of solution of the gas to the free energy of formation of holes the size of the gas molecules in a continuous fluid having the same surface tension as the solvent yields solubility values in good agreement with those observed.

4730 APTIC NUMBER 14103

Bockris, J. O'M. and C. A. Angell
SELF-DIFFUSION IN MOLTEN SALTS: CD IN CDCL2-KCL. Electrochim. Acta, 1(4):308-317, 1959. 16 refs.

A method is described for the determination of diffusion coefficients in fused salts which permits investigations of the diffusion of ions in molten salts under an applied potential gradient. Two columns of the same chemical composition are used, one which contains a radioisotope of the species. The total diffusate is determined by comparison of the activity of the initially inactive column, with a sample of salt containing a known mass of the radioisotope and having an activity equal to that of the radioactive column before diffusion. The diffusion coefficient of Cd in molten CdCl2-KCl increases with increasing molar fraction of KCl until this reaches 50 mole% and thereafter decreases. Molten CdCl2 contains associated CdCl2 which breaks down increasingly upon addition of KCl. The ions formed are complexed to CdCl3(-). This ion is the predominant Cd-containing entity at compositions above 50 mole% KCl. Application of the CdCl2-KCl model to an interpretation of the system suggests a reason for the 'hump' in the curves of the conductance isotherms. (Author abstract modified)

4731 APTIC NUMBER 14206

Bockris, J. O'M., S. R. Richards, and L. Nanis
SELF-DIFFUSION AND STRUCTURE IN MOLTEN GROUP II CHLORIDES. J. Phys. Chem., 69(5):1627-1637, May 1965. 48 refs.

The purpose of the work was to ascertain whether the Fuerth hole theory, which states that the heat of activation for transport in simple ionic liquids is dependent on melting temperature, applies to the more complex structures of the group II salts. Self-diffusion coefficients of both cations and anions in molten NaCl, KCl, CaCl2, SrCl2, ZnCl2, CdCl2, and HgCl2 were measured at constant pressure as a function of temperature over a 200 degree range using the 'diffusion-into-the-capillary' technique. The results were corrected for hydrodynamic end error. The data was used to test the degree of applicability of several models for the liquids. The heats of activation were predicted from a version of the hole model. The cations show a better fit to the Stokes-Einstein equation than do the anions, especially for the group II-A chlorides. Equilibrium properties indicated that for molten CaCl2, SrCl2, and BaCl2, there is an absence of appreciable complex formation. Were complex ions to exist, the Stokes-Einstein equation would not apply. Deviations from the Nernst-Einstein equation showed that the ions present are M(2 plus) and Cl(-) or MCl(plus) and Cl(-). Thus, the predominant ionic species are simple ions.

4732 APTIC NUMBER 14208

Bohdansky, J. and H. E. J. Schins
VAPOR PRESSURE OF DIFFERENT METALS IN THE PRESSURE RANGE OF 50 TO 4000 TORR. J. Phys. Chem., 71(2):215-217, Jan. 16, 1967. 9 refs.

The vapor pressures of cesium, rubidium, sodium, lithium, strontium, calcium, thallium, bismuth, barium, lead, and silver were measured by a recently-developed method which allows measurements in the range of atmospheres of pressure at high temperature (up to 2000 degrees). The vapor pressure of the metal was measured in a closed tube containing the test material. The tube was held in a vertical position and heated at the lower end with an RF coil; the upper end was connected by a small tube to an argon pressure vessel in order to fix a certain argon pressure in the tube. During operation, the inert gas is pushed into the upper part of the tube by the vapor flow of the liquid metal under test. The hot part of the tube has a constant temperature corresponding to the vapor pressure; this temperature was measured by a thermocouple or by a pyrometer. Under stationary conditions, the vapor pressure is equal to the gas pressure which can be measured outside the tube. Both measured values were used to determine the vapor pressure-temperature relation of the test material. The method is relatively independent of impurity concentration. All measured values for the different metals follow regression lines. The constants of these lines are given, as well as the boiling points and the latent heats of vaporization. A comparison of the experimental results with others in the literature gives generally good agreement and demonstrates the simplicity of the present method.

4733 APTIC NUMBER 14009

Boston, Charles R., David W. James, and G. Pedro Smith
THE ULTRAVIOLET SPECTRUM OF THE NITRATE ION IN MOLTEN MIXTURES OF ALKALI METAL NITRATES. J. Phys. Chem., 72(1):293-295, Jan. 1968. 2 refs.

The idea that the energy of the first ultraviolet band of the nitrate ion in molten mixtures of alkali metal nitrates could be linearly interpolated from the band energies of pure alkali nitrate metals was quantitatively tested for binary mixtures of alkali metal nitrates. The systems studied were $LiNO_3$-$NaNO_3$, $LiNO_3$-KNO_3, $LiNO_3$-$CsNO_3$, $NaNO_3$-$RbNO_3$, and KNO_3-$RbNO_3$. The energy of the band maximum is a linear function of mole fraction over the entire composition range for KNO_3-$RbNO_3$ and $NaNO_3$-$RbNO_3$, the two systems that do not contain $LiNO_3$. For the three mixtures that contain $LiNO_3$, the band energy shows small positive deviations from linearity. The effect of temperature on the band maximum is small and of the same magnitude for mixtures as for pure nitrates. The effect of composition on the energy of the band maximum is approximately an additive function of cationic composition for the mixtures. In general, the f number increases with increasing temperature, but the magnitude of the effect varies with system composition.

4734 APTIC NUMBER 13967

Brunnemann, M.
INFLUENCE OF THE PRESENCE OF NITROGEN ON THE COMBUSTION TEMPERATURE OF GAS MIXTURES. (Ueberden Einfluss der Anwesenheit von Stickstoff auf die Verbrennungstemperatur von Gasgemischen). Text in German. Brennstoff-Waerme-Kraft, 19(7): 344-349, July 1967. 3 refs.

The present study is concerned with the influence of N_2, introduced into the combustion reaction or present in the initial gas mixture, on the temperature of combustion. First, an outline of Reichert's method of computation is given which enables one to determine the actual reaction temperature by taking into account the dissociation processes. The computation proceeds from the enthalpy of the reaction and the reaction ratio, which characterizes the given composition of the gas mixture. With this method, the combustion temperatures of a few gaseous fuels mixed only with O_2 and in the presence of N_2 were determined. It was found that the reaction temperature decreases with increasing N_2 content, first slightly, then more rapidly, because a part of the energy liberated during combustion is used to preheat and then dissociate the N_2, which does not participate in the reaction proper. However, a particularly sharp drop in the reaction temperature is observed only at O_2:N_2 ratios lower than that in atmospheric air. The method of computation employed can be applied to liquid fuels as well. If the reacting substances are introduced into the reaction zone in the liquid state, one must use their enthalpies of reaction in the liquid state for computation. Moreover, it is possible, according to computational results and confirmed by tests, to regulate the temperature of the flame by controlled introduction of N_2 into the combustion reaction without changing the fuel: O_2 ratio.

4735 APTIC NUMBER 14102

Busson, N., S. Palous, J. Millet, and R. Buvet
CHEMICAL AND ELECTROCHEMICAL PROPERTIES OF WATER IN FUSED ALKALINE CARBONATES. (Proprietes chimiques et electrochimiques de l'eau dans les carbonates alcalins fondus). Text in French. Electrochim. Acta, 12(12):1609-1629, 1967. 17 refs.

Potentiometric and thermogravimetric investigations of the acid-base and redox properties of the solvent species in fused alkaline carbonates show that the acid-base system exchanging O^{2-} $H_2O/2OH^-$ is weak. This property made it possible to analyze the chemical transformation of fused carbonates into hydroxides under the influence of water vapor. The redox properties of hydrogen and its derivatives are discussed in relation to thermodynamic considerations. The operation of fuel cells containing fused carbonate electrolytes is explained in accordance with the data. A new type of fuel cell is suggested, in which polarization due to proton transport is suppressed by the buffer effect of the acid-base pair $H_2O/2OH^-$. Performance of such devices is compared to that of cells designed with a combustive mixture of oxygen and carbon dioxide. (Author abstract modified)

4736 APTIC NUMBER 14249

Calderbank, P. H.
CONTACT-PROCESS CONVERTER DESIGN. Chem. Eng. Progr., 49(11): 585-590, Nov. 1953. 9 refs.

An equation was derived to express the rate of SO_2 oxidation with a vanadium oxide catalyst in a flow-type isothermal reactor. The expression is applicable up to 100% conversion for a variety of commercial vanadium catalysts and up to 59% conversion under near-isothermal conditions and can be used to calculate the weight of a catalyst required to produce a given amount of conversion. The units used for the expression can be converted into tons H_2SO_4 produced/tons catalyst/day, the loading in tons multiplied by fractional conversion giving the reaction rate in tons H_2SO_4 produced at the relevant temperature and mean partial pressure of SO2, O2, and SO3. Reaction rate data from other sources are in broad agreement with the proposed equation, which was applied to an evaluation of adiabatic converters and converters with integral heat exchangers. Reaction rates, optimum temperature distribution, and the required amount of catalyst were determined. An adiabatic reactor producing 50 tons H2SO4 per day requires 14.7 tons of catalyst for 96% conversion of a feed. A reactor with a heat exchanger producing the same amount of H2SO4 requires 0.93 tons catalyst for 96% conversion. The calculated optimum temperature distribution does not differ greatly from that obtained in the converter with a heat exchanger.

4737 APTIC NUMBER 14252

Calderbank, P. H.
THE MECHANISM OF THE CATALYTIC OXIDATION OF SULPHUR DIOXIDE WITH A COMMERCIAL VANADIUM CATALYST: A KINETIC STUDY. J. Appl. Chem. (London), vol. 2:482-492, Aug. 1952. 21 refs.

The kinetics of the oxidation of sulfur dioxide on a vanadium catalyst in a flow-type reactor were investigated under isothermal conditions at 360 to 450 deg. The rate-determining step was found to be the rate of reaction between gaseous oxygen and the chemisorbed sulfur dioxide. Results at given temperatures were in good agreement with Langmuir isotherms and indicate the presence of at least two types of active centers. Both oxygen and sulfur dioxide are reversibily chemisorbed; oxygen is weakly bound with a heat of adsorption of 6.4 kcal, and sulfur dioxide is strongly bound with a heat of adsorption of 28.8 kcal. There is evidence that both adsorbed species possess considerable mobility on the surface. Adsorption rate equations indicate that oxygen is adsorbed by a second-order mechanism at a slower rate than the observed rate of reaction and sulfur dioxide by a third-order mechanism at a much faster rate of reaction. Adsorption equilibrium of SO2 can be assumed without sensible error. The adsorption measurements show that the number of given centers increases with temperature, as suggested by Volkenstein. The reaction between SO2 and an active center requires no activation energy, but a small activation energy may be required with O2. A mechanism is proposed for the catalytic oxidation of sulfur dioxide, the main features of which are fast third-order chemisorption, slow second-order reaction between gaseous O2 and chemisorbed SO2, and fast oxide dissociation or desorption. (Author abstract modified)

4738 APTIC NUMBER 14306

Chernyshev, V. N.
THE DYNAMICS OF MASS TRANSFER IN COUNTERCURRENT EXTRACTION EQUIPMENT. Intern. Chem. Eng., 6(4):608-618, Oct. 1966. 12 refs. (Also: Automat. Proizvod. Protsessov, no. 4:5-21, 1964).

The dynamics of extraction processes occurring in countercurrent equipment of the column type is investigated. The analysis is based on the constancy of the phase rates, the constancy of the equilibrium distribution coefficient, and the absence of longitudinal mixing. The results indicated that the mass transfer process in countercurrent equipment can be described with a number of simplifying assumptions by a partial differential equation of the hyperbolic type. The solution of this equation, which gives the concentration changes in time and position, can be represented by the superposition of two damped waves whose shapes are deformed with time. The propagation velocities of these waves act in opposite directions, and are equal to the velocities of the continuous and disperse phases. The shapes of the waves are determined by the concentration distribution curves over the column under the old and new steady-state conditions. The wave damping decrements are proportional to the velocities of the respective phases, and inversely proportional to the heights of the transfer units. The time constants of the transition process for the change in product composition occurring at the column outlet after a disturbance on the feed side are proportional to the change in the quantity of the material being investigated in the column and inversely proportional to the size of the disturbance causing the transient process. This general statement is the basis for the relationships obtained between the time constant of the transient process and the constructional features of the column, the height of a transfer unit, flow ratio, initial solution concentration, column loading, hold-up of disperse phase, and pulsation intensity. The methods enable a clear qualitative picture of the unsteady-state mass transfer in countercurrent equipment to be obtained and to determine the nature of the transient process. However, in view of the complexity of the mathematical solutions, they are suitable for practical calculations only when high-speed computers are used.

4739 APTIC NUMBER 14171

Chiotan, C., Maria Szabo, Ioana Zamfir, and T. Costea
CHEMICAL STATE OF RADIOSULPHUR IN NEUTRON-IRRADIATED SODIUM CHLORIDE AND POTASSIUM CHLORIDE. J. Inorg. Nucl. Chem., vol. 30: 1377-1388, 1968. 15 refs.

The chemical states of the radiosulfur produced by the neutron irradiation of NaCl and KCl were studied. Neutron-irradiated samples of NaCl and KCl were heated isothermally at temperatures between 150 and 725 C. The results showed that the reduced radiosulfur (S(2-) plus elemental sulfur) fraction (R) increases with the temperature and the length of heating. Phenomenological and kinetic evidence was presented for the existence of two annealing processes for which the activation energies and reaction orders were determined. At temperatures less than 350 C, a first order process takes place, possibly associated with the annealing of radiation damage. This leads to an increase of R as a result of the reduction in the oxidized sulfur fractions. At temperatures greater than 350 C, a second process was observed, evidenced by an increase in the elementary sulfur fraction at the expense of S(2-) and oxidized sulfur fractions. The proposed mechanism leads to the suggestion that the species S(plus), elemental sulfur, and S(-) exist in the crystals. (Author abstract modified)

4740 APTIC NUMBER 14304

Cohen, Morrel H. and David Turnbull
MOLECULAR TRANSPORT IN LIQUIDS AND GLASSES. J. Chem. Phys., 31(5):1164-1169, Nov. 1959. 27 refs.

A simple explanation is given for the mobility of molecules in liquids and its striking descrease, implied by the fluidity behavior, in the glass transition region. A relation between the diffusion coefficient in a liquid of hard spheres and the free volume (vf) was derived. This derivation is based on the concept that statistical redistribution of the free volume occasionally opens up voids large enough for diffusive displacement. The relation is D equal A exp (-gamma v*/vf), where v* is the minimum required volume of the void and A and gamma are constants. This equation is of the form as Doolittle's empirical relation between the fluidity of simple hydrocarbons and their free volume. It was shown that the Doolittle equation also can be adapted to describe the abrupt decrease in molecular kinetic constants with decreasing temperature that accompanies the glass transition in certain liquids. The results predict that even the simplest liquids would go through this glass transition if they were sufficiently undercooled and crystallization did not occur. The problem of transport in actual simple and network liquids is also discussed. It was shown that data on self-diffusion in some simple van der Waals liquids and liquid metals are described satisfactorily by the relation with v* near the molecular volume for the van der Waals liquids and near the volume of the ion, corresponding to the highest valence state for the metals. (Author abstract modified)

4741 APTIC NUMBER 14305

Conway, B. E., J. O'M. Bockris, and Hedda Linton
PROTON CONDUCTANCE AND THE EXISTENCE OF THE H3O(I) ION. J. Chem. Phys., 24(4):834-850, April 1956. 44 refs.

The conductance of HCl in nonaqueous and in aqueous-nonaqueous systems was studied and theoretical predictions were compared with experimental results. Five processes which could be rate determining in proton conductance in hydroxylic solvents were considered. Proton transfer between H3O(I) and H2O by quantum-mechanical tunneling is faster than corresponds to the experimental anomalous conductance and faster than the maximum possible rate by classical proton transfers. Both transfer processes give too high a value of the H(I)/D(I) mobility ratio. Rotation of H3O(I) ions is not advantageous for proton transfers and reorientation of H2O molecules is always necessary for successive proton transfers. Slow libration of H2O and H3O(I) molecules, followed by proton transfer was considered, but this process gives the wrong direction of change of mobility from H(I) in H2O to D(I) in D2O, and also leads to a conductance faster than that corresponding to water rotation. Reorientation of H2O molecules in the field of the H3O(I) ion was shown to be rate determining and the theory is supported by results of critical experiments on proton conductance in a series of alcohols and their mixtures with water. (Author conclusions modified)

4742 APTIC NUMBER 14010

Copeland, James L. and Walter C. Zybko
THE SOLUBILITY OF ARGON TO 451 ATMOSPHERES IN FUSED SODIUM NITRATE AT 369 DEG. J. Phys. Chem., 69(10):3631-3633, Oct. 1965. 12 refs.

The solubility of argon in fused sodium nitrate at 369 deg was determined to a maximum saturating pressure of 451 atm. The relationship between solubility and saturating pressure is linear and thus obeys Henry's law. The average slope calculated from the solubility of Ar vs saturating pressure yields solubility equation and a value for the Henry law constant which is in good agreement with the first crude results reported earlier by these investigators. Two extreme possibilities may exist for the probable distribution of Ar atoms throughout the liquid NaNO3. The gaseous atoms may take up holes of their own creation in the liquid or they may predominately occupy existing free volumes (as holes) in the liquid. (Author abstract modified)

4743 APTIC NUMBER 14295

Cox, C. S.
THE CAUSE OF LOSS OF VIABILITY OF AIRBORNE ESCHERICHIA COLI K12. J. Gen. Microbiol., vol. 57:77-80, 1969. 10 refs.

The uptake of uracil, pyruvate, methionine, and oxygen, and the breakdown of RNA and protein were examined in Escherichia coli K12 HfrC after storage as an aerosol for 15 min in nitrogen at 80 and 40% relative humidity (RH). At 80% RH, there was greatest loss of aerosol viability and almost complete breakdown of RNA, together with severe inhibition of energy production. At 40% RH, all these effects were mitigated. RNA synthesis was greater, release of methionine was slight, and oxygen uptake was still evident. Rehydration is assumed to cause dissociation of the RNA-protein complex, with the other changes following. It is not understood why rehydration at 40% RH should be so much less damaging than rehydration at 80% RH. (Author summary modified)

4744 APTIC NUMBER 14214

Cullen, K. J., T. A. Welborn, N. S. Stenhouse, G. McCall, and D. H. Curnow
VENTILATORY CAPACITY AND PRODUCTIVE COUGH IN A RURAL COMMUNITY. Brit. J. Prevent. Social Med. (London), 23(2):85-90, May 1969. 7 refs.

In 1966 a study was undertaken in the rural population of Busselton, Western Australia, in order to assess the predictive validity of various measurements relating to subsequent pulmonary and cardiovascular morbidity. This population was known to have a low incidence of respiratory disorders; the locale had no known industrial air pollution, little atmospheric dust in any season, and a mediterranean type of climate with 34 inches of annual rainfall. The study also tried to establish norms of ventilatory capacity for Busselton, to assess the empirical value of the productive cough test, and to make comparisons between South Wales and Busselton of the effect of age on ventilatory capacity. The British Medical Research Council's 1966 questionnaire on respiratory symptoms was used to obtain subjective evidence of respiratory disorders in the community; sputum production, measured by Hong and Gandevia's productive cough technique, was used as an objective measurement. After the cough test in each male subject, the forced expiratory volume at one second and the forced vital capacity were recorded by means of a McDermott dry spirometer. Results showed a greater decline with age in the ventilatory capacity of Welsh steel workers than of males from rural Busselton, thus appearing to objectively confirm previous subjective evidence that environments may differ significantly in their influence on respiratory function; smokers also showed a greater decline with age in ventilatory capacity than non-smokers. The low rates of chronic bronchitis in rural non-smokers gave strong indication that higher prevalence rates of this disorder in other populations are predominantly caused by inhaled irritants. The audible productive cough test was judged to have shown empirical validity under Australian conditions; it remains to be seen if this test is of better predictive value than subjective evidence of chronic bronchitis in relation to subsequent pulmonary morbidity.

4745 APTIC NUMBER 14239

De Levie, R.
ON POROUS ELECTRODES IN ELECTROLYTE SOLUTIONS. Electrochim. Acta, 8(10):751-780, 1963. 9 refs.

The capacitance of the ionic double layer at electrode/electrolyte solution interfaces can interfere with accurate measurements of electrode processes. The properties of capacitance effects influencing measurement were mathematically determined from a model in which the pores of the electrode surface were assumed to consist of circular cylinders of uniform diameter and to be filled homogeneously with electrolyte. The rate of mass transport as a function of diffusion was also investigated to determine the limits of the applicability of equations of plane diffusion in porous electrode processes. All calculations based on the porous model were derived from alternating current techniques. At low frequencies, the electroactive contents of the pore are used up within a small fraction of the cycle, the electrode reaction having as a capacitance. At increasing frequencies, the rate of diffusion of electroactive species toward and from the electrode determines the ac behavior of the electrode, but at still higher frequencies, the finite reaction rate is dominant. Finally, at the highest frequencies, the double layer capacitance alone determines behavior of the electrode. However, if the electrode reaction is fast enough, only diffusion control will be found; alternatively at a very slow reaction, only reaction control will be present. Both diffusion- and reaction-controlled parts may be absent when the 'pore exhaustion' region extends to such high frequencies that it passes directly into the double layer capacitance region. Since penetration depth decreases with frequency in ac techniques, the influence of pores is more important at low frequencies.

4746 APTIC NUMBER 14021

Dermer, Gerald B.
THE FIXATION OF PULMONARY SURFACTANT FOR ELECTRON MICROSCOPY. I. THE ALVEOLAR SURFACE LINING LAYER. J. Ultrastruct. Res., 27(1-2):88-104, 1969. 50 refs.

The morphologic demonstration of a surface-active alveolar lining of the epithelial surface of the lung was attempted. Biochemical studies reported in the literature indicated strongly that such a layer was present and that its major and surface-active component was a saturated phospholipid, dipalmitoyl lecithin. Previous electron microscopic studies of osmium-fixed, plastic-embedded lung tissue failed to reveal this layer or to give evidence supporting its existence. Because standard fixation techniques cannot be used to fix fully-saturated lipids, a tissue fixation scheme was developed which is effective regardless of whether the phospholipids are saturated or unsaturated. This technique (tricomplex flocculation by means of suitable ions) permitted the electron microscopic visualization of the phospholipid component of surfactant within lung tissue. After tricomplex fixation, a layer of electron dense, polymorphic material was seen lining the epithelial surfaces of alveoli. (Author abstract modified)

4747 APTIC NUMBER 14104

Detry, D., J. Drowart, P. Goldfinger, H. Keller, and H. Rickert
STUDY OF THE THERMODYNAMICS OF SULFUR VAPOR. MASS SPECTROMETRIC STUDIES WITH THE ELECTROCHEMICAL KNUDSEN CELL. (Zur Thermodynamik von Schwefeldampf. Massenspektrometrische Untersuchungen mit der elektrochemischen Knudsen-Zelle). Text in German. Z. Physik. Chem., 55(5/6):314-319, Aug. 1967. 13 refs.

Theoretical and experimental studies show that sulfur vapor contains not only S_2, S_4, S_6, and S_8 molecules, but also S_3, S_5, and S_7 molecules. An attempt was made to obtain exact thermodynamic data for all types of vapor molecules with the aid of an electrochemical Knudsen cell combined with a mass spectrometer. The Knudsen cell was directly arranged in the spectrometer instead of the ion source. Sulfur from solid silver sulfide was evaporated in the Knudsen cell according to the series $Pt,Ag/AgJ/Ag_2S,Pt$. The electric current, J, with the positive pole of an outside source applied on the right side of the series permitted variation of the discharge velocity of the sulfur from the cell and thus of the pressure of the sulfur vapor. For each stationary state, adjusted by electric current J, three variables were obtained, namely the electric current, the electromotive force, and the concentrations of the various types of S molecules after separation in the mass spectrometer. The concentration may be either that of primary molecules in the Knudsen cell or that which develops by fractionation of larger molecules by ionization. They are separately determined. With these variables and the sensitivity of the mass spectrometer, the partial pressures can be computed. Extrapolation of the straight line indicating the partial pressures to the saturation point yields the saturation partial pressures, which by addition, lead to the total pressure. The measurements were performed within a temperature range of 200 to 400 C. Enthalpies and entropies for the various molecules were computed.

4748 APTIC NUMBER 14006

Duke, F. R. and S. Yamamoto
ACID-BASE REACTIONS IN FUSED SALTS. II. THE ABSOLUTE CONCENTRATION OF NO2(PLUS) ION IN FUSED NITRATE. J. Am. Chem. Soc., vol. 81:6378-6379, Dec. 20, 1959. 1 ref.

The decomposition of pyrosulfate in a fused alkali nitrate mixture was studied at 235 and 275 deg. The reaction proceeded very rapidly at 235 deg but was retarded by the addition of sulfate, which indicated that a reversible reaction was involved. The reaction consists of two steps: first the equilibrium reaction S207(2-) plus NO3(-) yields NO2(I) plus 2SO4(2-) and then the slow reaction NO3(-) plus NO2(I) yields 2NO2 plus O. Values were obtained for the equilibrium, the pseudo first-order rate constant, and the reciprocal of the latter. Since the dichromate and the pyrosulfate reactions have the same slow step, the rate constant derived from this study can be used to calculate the equilbrium constant for the dichromate reaction.

4749 APTIC NUMBER 14216

Edeleanu, C. and P. Littlewood
THERMODYNAMICS OF CORROSION IN FUSED CHLORIDES. Electrochim. Acta, 3(2-4):195-207, 1960. 10 refs.

The thermodynamics of the metal/molten chloride system are considered with reference to metal corrosion. The prime factors which determine how much corrosion will take place in a given system are the nobility of the metal and the stability of the chloride. Other important factors are the initial redox potential of the melt, the solubility in the melt of the metal produced by reduction of the chloride, the pressure over the system, the solubility product of the metal oxide, and the presence of impurities, including water. It was suggested that since chlorides are mutually insoluble there is no possibility of passivity in pure chlorides, but, if other substances such as oxygen or oxygen-containing impurities are present, the corrosion product in the melt can be insoluble and there is then a chance of passivity. In the general case, it seems safer to avoid corrosion by aiming at immunity using relatively noble metals in the more stable chlorides. From the calculations, it seems that in relatively pure melts, nickel, which is only slightly more noble than iron, will cause very little contamination in melts which are initially pure. The thermodynamic approach is valid because in fused salts at the temperatures considered, the electrode reactions appeared to be even less polarized than in aqueous systems. It was found that true equilibrium will seldom establish itself if the concentrations of the reactants are very small, but it is not always necessary for an oxidizing agent to diffuse to the site of corrosion in order for a reaction to occur. In the case of alloys where equilibrium cannot be set up, corrosion can be expected to cause leaching of one of the constituents. Also, when a metal is in equilibrium with a melt, it is far from inactive; the equilibrium is a dynamic one.

4750 APTIC NUMBER 13994

Erdoes, E. and J. Bares
KINETICS OF THE REACTION BETWEEN SOLID SODIUM CARBONATE AND GASEOUS SULFUR DIOXIDE. (Die kinetik der Reaktion zwischen festem Natriumcarbonat und gasfoermigem Swefeldioxid). Text in German. Proc. Intern. Symp. Reactivity Solids, 5th, Munich, 1964, p. 676-685. 12 refs.

The rate of the reaction between solid sodium carbonate and gaseous SO2 was measured at 150 C at low partial pressures of SO2 and under approximately differential conditions. The reaction rate depends strongly on the water vapor content of the gas phase; the dependence of the reaction rate on the turnover rate of the solid phase possesses a maximum. For a quantitative description of this dependence, an additional factor is introduced which is a function of the instanterreous area of the contact surface between the interreacting phases and which may be viewed as a measure of the discrepancy between the conventional and a more detailed conceptual model of the reaction. The observed experimental results are consistent with the hypothesis that the reaction takes place at the contact loci of the three phases and that during the formation of the activated complex, the sulfur dioxide and the water vapor participate in the adsorbed state.

4751 APTIC NUMBER 14227

Farnsworth, H. E. and R. F. Woodcock
EFFECTS OF RADIATION QUENCHING, ION-BOMBARDMENT, AND ANNEALING ON CATALYTIC ACTIVITY OF PURE NICKEL AND PLATINUM SURFACES. II. HYDROGENATION OF ETHYLENE (CONTINUED). HYDROGEN-DEUTERIUM EXCHANGE. Advan. Catalysis, vol. 9:123-130, 1957. 11 refs.

A method for cleaning a wide variety of solid surfaces in high vacuum permits the separation and individual investigation of factors affecting the chemical properties of catalysts: lattice defects, electronic and geometric factors, and contaminants, including chemisorbed gas. The method consists of high-temperature outgassing, radiation quenching, argon-ion bombardment, and annealing and is applicable to both single crystals and polycrystalline forms. A mass spectrometer provides continuous or intermittent gas analysis. In experiments involving the hydrogenation of ethylene or nickel and platinum catalysts, catalytic activity after ion bombardment was essentially the same as that after radiation quenching. Activity after these treatments is higher than after subsequent annealing, suggesting that annealing removes surface lattice defects which contribute to high activity. Results also indicate that small amounts of impurities promote catalytic activity, while larger amounts of the same impurity act as a poison. Measurements of hydrogen-deuterium exchange on a nickel surface revealed no appreciable difference in activities of annealed and quenched surfaces, indicating that the rate-controlling factor for the hydrogen-deuterium reaction is not the same as that for the hydrogen-ethylene reaction.

4752 APTIC NUMBER 14067

Fritsch, E., J. Gerlach, and F. Pawlek

ON THE KINETICS OF THE REACTION BETWEEN PURE AND FE2O3-CONTAINING NACL OR CACL2 AND A GAS PHASE OF SO2, O2 AND SO3. (Zur Kinetik der Reaktion zwischen reinem und Fe2O3-haltigem NaCl oder CaCl2 mit einer Gasphase aus SO2, O2, und SO3). Text in German. Z. Anorg. Allgem. Chem., 344(5/6):248-262, 1966. 16 refs.

Compressed and sintered test specimens of pure ferric oxide (Fe2O3) or pulverized crystalline NaCl and CaCl2, either pure or mixed with 1% or 10% by weight of Fe2O3, were exposed at 500, 550, or 600 C for 150 min to slow-streaming mixtures of various proportions of SO2, O2, and SO3. The reaction rates for the formation of Fe, Na, or Ca sulfates were determined by measurements of weight increments of the metal compounds. In all tests, the reaction rates increased with temperature. In the absence of SO3, the reaction rate of pure Fe2O3 increased linearly with the SO2 content of the gas mixtures, whereas the much lower reaction rates of pure NaCl and CaCl2 increased nonlinearly with the SO2 content to a maximum at 20 mole-% SO2 and gradually decreased to zero in pure SO2. In the presence of Fe2O3 admixtures, these lower reaction rates increased greatly with the Fe2O3 content, while the form of their variation with the SO2 content remained unchanged. In the presence of SO3, the reaction rate of pure Fe2O3 greatly increased with the SO3 content, becoming effectively independent of the SO2 and O2 contents above 1 mole-% SO3. The same is true of the reaction rates of NaCl and CaCl2, both alone and with Fe2O3. In the latter case, the effect of Fe2O3 on these rates was greatly attenuated. It was concluded that the process of Na2SO4 and CaSO4 formation with Fe2O3 admixtures in a mixture of SO2 and O2 is effected only through the intervention of SO3 in the chemisorbed layer of SO2 catalyzed by Fe2O3. In the presence of SO3 admixtures, the role of this intermediate process is insignificant.

4753 APTIC NUMBER 14191

Prysinger, Galen R.
FAST TRANSIENT RESPONSE FUEL CELL - BATTERY HYBRID POWER SOURCE. Preprint, Society of Automotive Engineers, Inc., New York, 8p., 1969. 6 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690205.)

The electrical and thermal integration of a molten carbonate fuel cell with a molten electrolyte battery to produce a highly efficient power source with a fast transient response is described. The fast transient response can be extremely useful in systems where larger amounts of power and intermittent high-power densities are required. Hybrid load coupling by matching the discharge impedance of the battery and the fuel cell can be maximized in those systems where special battery-type sections are specially designed to match the fuel cell energy source. This type of electrically integral hybrid not only has the unique discharge characteristics but also has the proper recharge balance. The reserve energy of the battery prevents the fuel cell from reaching excessive polarization and low voltage just as the fuel cell's limited power producing capability at higher voltages prevents excessive overcharge of the battery. It was concluded that ceramic monoblock construction of a hybrid package can be designed with optimum response characteristics as well as the ability to accept high reverse power flow.

4754 APTIC NUMBER 14049

Puertig, Helmut and Friedrich Wolf
INVESTIGATION OF THE PROPERTIES OF ION-EXCHANGED MOLECULAR SIEVES OF TYPE A WITH THE HELP OF GAS-ADSORPTION. (Untersuchung der Eigenschaften von ionenausgetauschten Molekularsieben des Typs A mit Hilfe der Gasadsorption). Text in German. Tonind. Ztg. Keram. Rundschau (Goslar), 90(7):297-303, 1966. 15 refs.

An account is given of the properties and structural alterations of ion-exchanged molecular sieves of type A, which are studied by measuring the gas adsorption. In the dehydrated state, the original molecular sieve has a composition corresponding to the bulk formula 0.922 Na2O.Al2O3.1.888 SiO2. The characteristic properties of the material are reported. A partial to complete ion exchange of Na(I) against Li(I), K(I), Ag(I), Mg(II), Ca(II), Sr(II), Ba(II), Co(II), Mn(II), Ni(II), and Zn(II) occurs in this material. After subsequent thermal treatment, the adsorption isotherms were determined in the pressure range above 5 Torr for N2, O2, SO2, and n-butane. An hypothesis is offered for the variations in the pore size, and the decomposition phenomena in the molecular sieve lattice are described. (Author abstract modified)

4755 APTIC NUMBER 14027

Gaines, L.
SECONDARY SILVER-ZINC BATTERY TECHNOLOGY. J. Electrochem. Soc., 116(2):61C-67C, Feb. 1969. 31 refs.

A review of the current status of silver-zinc battery technology is presented as part of an attempt to organize, on a fundamental basis, the varied design improvements developed as a result of empirical studies. Currently available secondary silver-zinc cells, which represent an attempt to convert the primary silver-zinc system into a high-energy density rechargeable energy storage device, are not altogether satisfactory. Past efforts to improve the secondary silver-zinc system have been devoted to (a) stabilization of the zinc electrode structure, (b) control of zinc dendrite growth, (c) increasing the utilization of the silver electrode, (d) separator improvements, and (e) development of sealed batteries. Experiments reported in the literature on these subjects are summarized, and the results are integrated with the basic electrochemical and physical principles of battery operation. Improvements that have been suggested in these areas are often mutually exclusive and interdependent. Clarification of the fundamental processes involved is necessary for the creation of an optimum battery configuration. (Author abstract modified)

4756 APTIC NUMBER 14169

Gal, I. J., J. Mendez, and J. W. Irvine, Jr.

DISTRIBUTION OF SOME SIMPLE AND COMPLEX ANIONS BETWEEN MOLTEN LITHIUM NITRATE-POTASSIUM NITRATE AND TETRAHEPTYLAMMONIUM NITRATE IN POLYPHENYL. Inorg. Chem., 7(5):985-991, Jan.-June 1968. 15 refs.

In an effort to extend solvent extraction studies to molten salt systems, the distribution of chloride, perrhenate, and AgCl2(-) ions between a eutectic molten salt mixture of LiNO3-KNO3 and a solution of tetraheptylammonium nitrate in a polyphenyl solvent was studied at 150 deg. The distribution of the anions was interpreted in terms of a simple anion-exchange equilibrium followed by polymerization of some species in the organic phase. The equilibrium constants for the anion exchange and the dimerization constants were calculated, and the dependence of the perrhenate distribution on the temperature was determined. The stability constants of AgCl and AgCl2(-) species in the nitrate melt were derived from the distribution data. The activity coefficients of the solute and nitrate salts follow, up to a solute mole fraction of 0.1, an expression derived from a simple model of molten salt mixtures. (Author abstract modified)

4757 APTIC NUMBER 14189

Gaube, Johann, Ottmar Knacke, Hans Lydtin and Hartmut Pohl
METALLURGICAL PHASE DIAGRAMS OF IRON COMPOUNDS. (Metallurgische Zustandsbilder von Eisenverbindungen). Text in German. Arch. Eisenhuettenw., 34(9):653-658, Sept. 1963. 17 refs.

For the system Fe-FeO-Fe3O4-Fe2O3-FeS-FeS2-Fe2(SO4)3, phase diagrams were computed and drawn from thermodynamic parameters obtained by Kubaschewski and Evans. The diagrams show phase limits of individual substances as functions of the temperature and the pressure conditions of the gas pairs SO3/SO2, CO2/CO, H2O/H2, H2/H2S and the partial pressures of O2 and S2. The computed phase limits were compared with measured values taken from the literature. The comparison shows that some phase limits, such as Fe3O4/Fe2O3 and FeS/FeS2, have been less accurately investigated than others in this system. The pronounced break at the phase limit Fe/FeO at the melting point of wustite is rather striking. According to the phase diagram, the melting heat of wustite is 13.8 kcal/mole which is uncommonly high, while the literature provides a value of 7.4 kcal/mole. Phase diagrams are indispensable in metal production. The customary smelting and roasting of the iron sulfides and subsequent reduction with carbon is a thermodynamic necessity. Reduction alone yields no metal. For any roasting process, the phase diagrams indicate at which temperatures and oxygen partial pressures iron(II,III) oxide, iron(III) oxide, or sulfate occurs as end product. They also provide information on the kinetics of roasting and all intermediary phases of the roasting process.

4758 APTIC NUMBER 14218

Gaur, H. C. and H. K. Behl
ELECTRODE POTENTIALS IN FUSED MAGNESIUM CHLORIDE-SODIUM CHLORIDE-POTASSIUM CHLORIDE EUTECTIC. Electrochim. Acta, 8(3):107-114, 1963. 31 refs.

The ternary eutectic system MgCl2-NaCl-KCl has attracted attention as a solvent because of its suitability for the extraction of fission products. As part of an extended electrochemical investigation of the solvent, standard electrode potentials for chromium, iron, and copper in 50:30:20 mole % fused MgCl-NaCl-KCl at 475 deg were measured on molality and mole fraction scales. Molality scale measurements for the electrodes studied vs the standard reference electrode Pt(II)/Pt(0) are -1.396v for Cr(II)/Cr(0), -1.131v for Cr(III)/Cr(0), -0.602v for Cr(III)/Cr(II), -0.947v for Cu(I)/Cu(0), -0.519v for Cu(II)/Cu(0), -0.091v for Cu(II)/Cu(1), -1.183v for Fe(II)/Fe(0), -0.852v for Fe(III)/Fe(0), and -0.190v for Fe(III)/Fe(II). Mole fraction scale measurements for these systems are, respectively, -1.396, -1.159, -0.685, -0.863, -0.519, -0.175, -1.183, -0.880, and -0.274. Attempts are in progress to obtain values of activity coefficients of PtCl2 in this solvent with a chlorine/chloride-ion electrode. These will enable accurate determination of individual activity coefficients of the metal chlorides.

4759 APTIC NUMBER 14220

Gilbert, Everett E. and E. Paul Jones
SULFONATION AND SULFATION. Ind. Eng. Chem., 53(1):501-507, Jan. 1961. 167 refs.

The literature published in 1960 on the chemistry of sulfonation and sulfation is reviewed. New procedures are reported and the properties and possible uses of new products are summarized. Topic headings include the direct sulfonation of polyethylene film, alpha-sulfonation of pelargonic acid with SO2, oxidative sulfonation by aqueous chlorination of trithiane, sulfonation with SO2 compounds, polymerization and condensation methods, aromatic sulfonation with H2SO4, the preparation of long-chain alkylated aromatics, the preparation of polystyrene and aromatic resins, benzene and naphthalene derivatives, the direct preparation of aromatic sulfonyl chlorides, sulfation of alkenes, monohydric alcohols, glycol esters and ethers, and the sulfamation of cyclohexylamines and insulin.

4760 APTIC NUMBER 14154

Gordon, Saul and Clement Campbell
DIFFERENTIAL THERMAL ANALYSIS OF INORGANIC COMPOUNDS. NITRATES AND PERCHLORATES OF THE ALKALI AND ALKALINE EARTH GROUPS AND THEIR SUBGROUPS. Anal. Chem., 27(7):1102-1109, July 1955. 12 refs.

The use of differential thermal analysis to investigate the thermal decomposition of inorganic oxidants to determine and characterize their behavior and reactions at elevated temperatures from ambient to approximately 800 C is described. Although the curves obtained by this technique are unique and characteristic for the individual compounds, relatively little work has been reported on the use of differential thermal analysis for this purpose other than in the field of mineralogy. The parameters established for the system were maintained constant, and a heating rate of approximately 15 C per minute was employed to permit comparison of the curves under uniform conditions. The main objectives were to determine the reproducibility of the curves obtained by this method, to observe the phase changes and stages of decomposition undergone by the compounds at predetermined heating rates, and to characterize the various types of decomposition phenomena. The differential thermal analysis curves for the thermal decomposition of the nitrates and perchlorates of the alkali metals, alkaline earths, and their subgroups are presented. The thermal reactions reported include dehydration, crystalline transition, fusion, bubbling and/or boiling, and the various stages of visible decomposition. The transition temperatures for salts which undergo crystalline transformations were determined from the differential thermal analysis curves and were compared with reported values. (Author abstract modified)

4761 APTIC NUMBER 14082

Green, Gareth M.
PULMONARY ANTIBACTERIAL MECHANISMS AND THE PATHOGENESIS OF PULMONARY DISEASE. Yale J. Biol. Med., 40(5-6):414-435, April-June 1968. 17 refs.

The antibacterial activity of the lung was investigated in animal models as a possibly useful measurement index for identifying individuals or populations susceptible to chronic lung disease, either through uncovering a genetic predisposition or detecting the diseased individual in an asymptomatic state and in time for preventive therapy. The microbicidal action of the lung, which is related to the inactivation rather than the removal of inhaled particles, was found to fill the necessary criteria for a meaningful physiologic parameter: it is relevant to the pathophysiology of the lung, is quantitatively measurable in vivo so that small changes in function may be detected, and it reflects abnormality in response to the many factors which epidemiologically have been associated with the pathogenesis of lung disease, including air pollution, industrial exposure, diet, smoking, and drinking habits, socioeconomic factors, genetic influences, and previous medical history of an individual.
In the noninflamed lung, the primary microbicidal mechanism appears to be the alveolar macrophage; this mechanism is central to the defense of the lung against the general particulate burden of the external environment and functions in a region of the lung, the respiratory membrane, that reacts readily to gaseous agents in the environment. This region is also in intimate contact with the internal milieu so that cells of the region should reflect metabolic changes throughout the body. In the present model, bacteria are used as the challenge particulate and the microbicidal activity of the lung as its functional index. Animals are exposed to bacterial aerosols of suitable size in a constant flow exposure chamber. At intervals after infection, the animals are killed and the lungs are cultured quantitatively. The depresent effect of cigarette smoke, virus infection, and organic disease on the bactericidal mechanism are discussed, and tentative correlations with epidemiological evidence of lung disease pathogenesis, with some emphasis on chronic bronchitis, are hypothesized. A record of a discussion of the paper is included.

4762 APTIC NUMBER 14088

Greenberg, Jacob, Benson P. Sundheim, and Dieter M. Gruen
SOLUTIONS OF SULFUR IN FUSED SALTS. J. Chem. Phys., 29(2):461, Aug. 1958. 3 refs.

Observations on solutions of sulfur in fused salts were made to help clarify the problem of the molecular constitution of sulfur. Blue solutions were obtained when sulfur was added to an evacuated cell containing a fused LiCl/KCl eutectic mixture at 400 C. The absorption spectrum of the solution was compared to the spectrum of sulfur in LiBr/KBr. These spectra were independent of the anion, which clearly showed that the spectrum does not involve specific interaction between the sulfur and the halide ion. A blue solution was also obtained upon heating KSCN to about 400 C. The absorption spectrum was shown to be similar to the other two spectra, indicating that the sulfur species responsible for the spectra are the same in all three cases. It was possible that the blue color in the solvents was due to diatomic sulfur molecules in a triplet ground state. Gouy measurements showed very small positive forces when the lower section of the Gouy tube was filled with pure LiCl/KCl eutectic and the upper one with a 1M solution of sulfur in LiCl/KCl. Although it was shown that the solution contains a paramagnetic species, the large scatter in the experimental points precluded calculation of the radical concentration.

4763 APTIC NUMBER 14059

Gruner, E.
THE OSMOTIC AND ZEOLITIC BINDING OF THE VOLATILE PHASE. (Die osmotische und zeolithische Bindung der fluechtigen Phase). Text in German. Kolloid-Z. (Germany), 111(1):31-46, 1948. 117 refs.

The binding of water to a solid phase is classified as chemical binding, sorption, capillary binding, or osmotic-zeolitic binding. It is shown by means of examples of oxides, permutites, and zeolites that the latter form of binding occurs in various forms and therefore a distinction should be made between osmotic and zeolitic binding of water. By definition, osmotic binding exists if the water can move freely within the lattice and if it is not subjected to chemical forces. In this case, the water vapor pressure follows Raoult's law. Zeolitic binding exists more commonly. In this case, the water is subjected to chemical and other forces. Instead of Raoult's law, Huettig's law applies. Osmotic binding is known only in some oxide hydrate gels and in permutite, $Na_2O.Al_2O_3.2SiO_2.2H_2O$. Analogies to sulfur, ammonia, and carbon dioxide are pointed out. Sulfur is zeolitically bound in ultramarine. If ultramarine is melted with NaCN, both NaSCN and Na_2S are formed, proving the chemical activity. Zeolitic ammonia is found among other substances in hexamine-magnesium-iodide and chabasite. Zeolitic CO_2 is found in $CaCO_3$. The addition of SO_2 to permutites, e.g. $(Al_2Si_2H_4O_{10})H_2.SO_2$, is probably also zeolitic.

4764 APTIC NUMBER 14155

Hamill, William H.

ION-MOLECULE REACTIONS. J. Chem. Educ., 36(7):346-349, July 1959. 17 refs.

The study of the reactions between gaseous ions and molecules, a fundamental problem in radiation chemistry, is reviewed. Early work on the problem and current theoretical considerations are summarized, and experimental aspects are described in terms of the use of the mass spectrometer, the source of most current information concerning ion-molecule reactions. Thermochemical methods of testing mass spectrometric appearance potentials are discussed, and a thermochemical cycle is presented based on the principle that ion-molecule reactions, to be observed in a mass spectrometer, must have zero activation energy. In a discussion of criteria, measured reaction cross sections at ion energies of about 1 ev are placed in the range 50-200 times 10 to the minus 16 sq cm and are described as independent of temperature. Recent work is reviewed and found to demonstrate qualitatively the decreasing cross section with increasing ion velocity. The limitations of mass spectrometry in the development of radiation chemistry are considered.

4765 APTIC NUMBER 14164

Hansen, Andrew C., Jr.
CONVERSION OF SULFUR-CONTAINING HYDROCARBONS. (Universal Oil Products, Co., Inc., Des Plaines, Ill.) U. S. Pat. 3,461,062. 6p., Aug. 12, 1969. 1 ref. (Appl. Sept. 6, 1966, 9 claims).

A principal object of the invention is the production of high octane gas by an economical combination of hydrorefining and catalytic reforming of hydrocarbon mixtures contaminated with sulfur compounds. A related object is the integration of a hydrocarbon conversion process with a hydrocarbon treating process. One embodiment of the invention involves a combination process for the conversion of sulfur-containing hydrocarbon stock charge. This comprises the steps of (a) contacting a naphtha charge stock and hydrogen with a cobalt-molybdenum hydrogenation/desulfurization catalyst in a fixed bed reactor at conditions selected to convert sulfurous compounds to hydrogen sulfides and hydrocarbons; (b) removing hydrogen sulfide from the hydrorefined effluent; (c) introducing at least a portion of the remaining effluent into a conversion zone where the hydrocarbons are contacted with a catalyst of alumina, platinum, and combined chloride; and (d) recycling at least a portion of the conversion zone effluent to combine with an alkylaromatic hydrocarbon stock charge prior to contacting the latter in the hydrorefining zone, and separating the remaining conversion zone effluent to provide a hydrogen-rich gaseous phase and a normally liquid carbon product. The process produces a substantially debutanized pentane plus product in amounts from 3020 to 3880 b/d. Two changes are instituted in the combination process for catalytically reforming sulfur-containing hydrocarbon charge stock. A portion of the hydrorefined effluent is introduced into a catalytic reforming reaction zone containing a platinum catalyst, and the total reformed effluent is combined with a stock charge of gasoline boiling range hydrocarbons prior to contact in the hydrorefining zone.

4766 APTIC NUMBER 14211

Hansson, Roy and Gunnar Sundstrom
DETERMINATION OF CARBON MONOXIDE IN BLOOD REQUIRING MINIMUM EQUIPMENT. (Kolmonoxidbestamning i blod med ett minimum av utrustning). Text in Swedish. Nord. Med., 82(32):981-984, 1969. 7 refs.

A modification of Sachs' method which permitted analysis with a minimum of skilled manual work and equipment was used with the aid of commercially available indicators for the direct determination of carboxyhemoglobin. The method works with a coefficient of variation decreasing from approximately 15-5% when the carboxyhemoglobin increases from physiological values to 50%. The decreased volume of the carrier gas leads to a uniform decrease of the indicator readings which are more distinct and easily corrected using a factor of 1.4. The modification seems to work well in cases of carbon monoxide poisoning. Although the possibility of distinguishing hyperhemolysis from normal physiological conditions exists, it seems desirable to improve the exacting conditions either by increasing the blood sample volumes or by slimming the indicator tubes for medical purposes. (Author abstract modified)

4767 APTIC NUMBER 14138

Heric, E. L.
A PHASE RULE EXPERIMENT: THE SYSTEM LEAD NITRATE-SODIUM NITRATE-WATER. J. Chem. Educ., 35(10):510-513, Jan.-Dec. 1958. 7 refs.

A phase rule experiment involving a solid-liquid system is described and suggested to be of greater value to physical chemistry students than the experiments on ternary systems given in current textbooks, involving systems containing only liquid phases. In the experiment described, the analytical procedure was reduced to a minimum, the determination of total anhydrous solids. This was accomplished by extension of the wet residue method of Schreinemakers and the method of algebraic extrapolation so that a knowledge of the composition of two synthetic samples on the same tie line is used to fix the latter. While the principles involved are presented in terms of the system lead nitrate-sodium nitrate-water, the method is not specific and might be applied to many ternary systems in which one of the components is easily separable from the others. Evidence indicates that with several refinements the method may also be a suitable tool for research, especially for some of those systems where the usual methods of analysis are not satisfactory. The apparatus, materials, and calculations of the experiment are fully described.

4768 APTIC NUMBER 14289

Hohmann, Hans and Horst Huckauf
INVESTIGATIONS OF THE SYSTEM $CACO_3$-SO_2-H_2O(D) IN CONNECTION WITH PROBLEMS OF DUST AND SO_2 EMISSION FROM CEMENT KILNS. (Untersuchungen zum System $CaCO_3$-SO_2-H_2O(d) in Verbindung mit Problemen der Staub- und SO_2-Emission von Zementbrennaefen). Text in German. Silikat Tech., 20(5):148-155, 1969. 23 refs.

The four alkali earth carbonates (CaCO3, travertine, limestone, and dolomite) were studied with respect to their adsorption of sulfur dioxide and water vapor using gas chromatography. It was found that CaCO3 dried at 180 C at first adsorbs considerable quantities of SO2 from a SO2- and CO2-containing gas. The SO2 adsorption isotherms found by the frontal gas chromatographic process of G. Schay all belonged to type I of Brunauer's classification. Water vapor adsorption of all four carbonates was determined at 20, 40, 60, and 80 C. The water vapor adsorption isotherms were found to belong to type II of Brunauer's classification. Studies by the gas chromatographic pulsed flow method showed that SO2 adsorption by the system CaCO3-SO2-H2O at temperatures ranging from 0 to 100 C occurs at relative water vapor partial pressures of almost 1.0. Chemical conversion of SO2 to calcium sulfite occurs at partial pressures down to zero. This leads to the conclusion that formation of the adsorbed water vapor into a three dimensional fluid at the absorbent surface is a more thorough process than all known theories concerning water vapor adsorption on solids have anticipated. A critical relative water vapor partial pressure for calcium sulfate formation was found at 0.50, above which higher chemical activity occurs. Calcium sulfite (at oxidation) or calcium sulfate solidifies calcium carbonate dust and changes its surface properties. Cloth filters and electrostatic precipitators are thus hampered in their function. Five known types of waste gas of desulfurization are discussed.

4769 APTIC NUMBER 14230

Ingraham, T. R. and P. Marier
KINETICS OF THE THERMAL DECOMPOSITION OF ZNSO4 AND ZNO-2ZNSO4. Can. Met. Quart., 6(3):249-261, July/Sept. 1967. 9 refs.

Pelletized samples of alpha-ZnSO4, beta-ZnSO4, and ZnO-2ZnSO4 were decomposed in a stream of nitrogen on a recording thermogravimetric device. Each decomposition reaction is typically topochemical and follows linear kinetics. A regression expression was calculated for each linear rate constant. The corresponding activation energy for the decomposition of alpha-ZnSO4 is 92 plus or minus 3 kcal/mole; for beta-ZnSO4, 50 plus or minus 3 kcal/mole; and for ZnO-2ZnSO4, 58 plus or minus 3 kcal/mole. The effect of partial pressures of SO3 on the rate of decomposition of ZnO-2ZnSO4 suggests that SO3 is strongly adsorbed on the ZnO reaction product. Reverse reactions for the formation of ZnO-2ZnSO4 and ZnSO4 from ZnO are very slow and completed in a reasonable time only when fine particles of ZnO are involved. In the absence of good experimental techniques for handling powdered material in a noncompacted form, measurement of sulfation rates is not possible.

4770 APTIC NUMBER 14179

Iyengar, R. D. and V. V. Subba Rao
ELECTRON SPIN RESONANCE OF NITROGEN DIOXIDE (NO2) ADSORBED ON ZINC OXIDE. J. Am. Chem. Soc., 90(12):3267-3269, June 5, 1968. 19 refs.

The electron spin resonance (esr) spectra of NO2 adsorbed on zinc oxide was investigated. Tests was made on high-purity zinc oxide samples with surface areas of 3 square meters per gram. Before the treatment with ultrahigh-purity NO2, samples were outgassed for 2 hours at 500 C 0.000001 torr. The resulting esr spectra were reprinted and discussed. The outgassing procedure and thermodynamics were varied, and subsequent signal changes were analyzed. Chlorine treatment of the sample was seen to produce a sharp signal at g equal 2.015, indicating that the same peak previously noted was not due to chemisorbed oxygen atoms, the previous notion. Investigations to this point suggest the presence of shallow levels on ZnO which give rise to the signal after the loss of an electron to the interacting gas at the surface.

4771 APTIC NUMBER 14130

Jagitsch, Robert
CONVERSION OF MINERAL SALT WITH ROASTING GAS. (Ueber die Umsetzung von Steinsalz mit Roestgas). Text in German. Trans. Chalmers Univ. Technol., Gothenburg, Sweden, no. 76, 16p., 1948. 9 refs.

To determine the reaction rate of NaCl with roasting gas (with the formation of sulfate and chloride), gas consisting of 8% SO2 and 92% O2 was passed over a sample of salt. A flow velocity of 0.55 liters SO2/hour was held constant. The weight increase of the salt was taken as a direct measure of reaction rate. The results show that sulfate formation diminished as the salt grains became smaller. Furthermore, it was found that the reaction rate was independent of the thickness of the converted layer. To test the dependence of the reaction rate on temperature and gas composition, similar experiments were performed with different SO2:O2 ratios and temperatures. At constant temperatures, it was found that increasing SO2 concentrations increased reaction rate. In a series of analogous experiments, the extent of chloride formation was studied. It was found that chloride formation correlated well with sulfate formation within the error limits. A theoretical example for the conversion of 1 ton of NaCl with roast gas was given, and it was found that not all the salt is converted. The duration of the conversion process and the original quantity of NaCl must be 1.5 times the daily output.

4772 APTIC NUMBER 14092

James, David W.
THE RATE OF OXIDATION OF NITRITE IONS IN DILUTE SOLUTIONS OF SODIUM NITRITE IN MOLTEN LITHIUM PERCHLORATE. J. Phys. Chem., 72(3):876-879, March 1968. 12 refs.

Quantitative data on a slow reaction between oxo anions in an ionic melt were obtained by adding small amounts of NO2(-) in the form of NaNO2 to molten LiClO4 and simultaneously oxidizing the NO2(-) anions to NO3 and reducing the solvent ClO4(-) anions to Cl(-) at 245-301 deg. The reaction isotherm was measured spectrophotometrically by determining the change with time of the absorption intensity of the NO2(-) and NO3(-) bands. Results show that the simultaneous oxidation and reduction is a pseudo first-order homogeneous reaction. The first-order rate constant is 0.000351/sec at 274 deg, and the activation energy is 31.5 kcal/mol. There is no buildup of per chlorate ions during the course of the reaction. The reaction is unaffected by gaseous nitrogen or substantial additions of water, LiOH (5 mol%), $LiNO_2$ (10 mol%), or gaseous oxygen. The evidence suggests the possibility that the rate-determining step involves a direct oxygen transfer between a nitrite and a perchlorate ion. (Author abstract modified)

4773 APTIC NUMBER 14310

Joint AMC/NMC/AFSC Commanders, Interservice Technological Forecasting Methodology Study Group
REPORT ON TECHNOLOGICAL FORECASTING. 136p., June 30, 1967. 161 refs.
CFSTI, DDC: AD 664165

The utilization of a system of logical analysis which, when applied to pertinent technological data, can result in credible and explicit technological conclusions is described. The study group attempted to evaluate, by survey and literature, possible forecasting techniques and conceptual approaches to technological forecasting. The manual is directed toward scientific and engineering specialists who may be asked to contribute inputs to forecasts but who may have only limited understanding of technological forecasting and its possible approaches and problems. A complex, controversial subject is clarified and an increased use is recommended of a number of techniques and a synoptic viewpoint that can improve the credibility and utility of forecasts provided by these specialists. It is emphasized that none of the methods is universal, nor should any be used as mechanistic black box approaches as a substitute for the informed judgement of the forecaster. The utility lies in enabling the forecaster to structure the available information so that the pattern of technological advance becomes more visible. If properly used, they can be expected to lead to a systematic, logical method of analysis conducted within a broader problem context. (Author abstract modified)

4774 APTIC NUMBER 14011

Jordan, Joseph
SIGNIFICANCE OF RATES AND EQUILIBRIA IN ELECTROANALYTICAL CHEMISTRY. Anal. Chem., 27(11):1708-1711, Nov. 1955. 16 refs.

On the basis of Nernstian equilibria and kinetics, reversibility and irreversibility of simple electrode reactions were interpreted in terms of two competing rate processes, i.e., mass transfer and electron transfer. The corresponding relationships were illustrated by experiments of hydrodynamic voltammetry where current-voltage curves were determined in solutions which were allowed to stream with varying flow velocities past a stationary indicator electrode. By adjusting the rate of flow, the shape of the current-voltage wave of ferricyanide can be changed from reversible to irreversible over an appreciable range of potentials. A generalized wave equation was derived for current voltage curves obtained by hydrodynamic voltammetry, which can be used for the determination of the rate of electron transfer. Because the latter is a monotonic exponential function of the potential, control by mass transfer prevails whenever a true limiting current is attained, irrespective of the apparent reversibility or irreversibility of the ascending portion of the wave. Since the rate of diffusive and/or convective transport is in all known instances proportional to the bulk concentration of the electroactive species, limiting currents of this type may always be applied with confidence to quantitative analysis. Hydrodynamic voltammetry appears to be ideally suited for the accurate determination of the rates of electron transfer processes involving interactions between soluble electroactive species and the electrode. (Author abstract modified)

4775 APTIC NUMBER 14953

Kadlec, B. and V. Pour
OXIDATION OF SULPHUR DIOXIDE ON A VANADIUM CATALYST IN THE REGION OF INTERNAL DIFFUSION. II. EXPERIMENTAL STUDY. Collection Czech. Chem. Commun. (Prague), 33(8):2526-2539, 1968. 15 refs.

Reaction rates of SO_2 oxidation in the diffusion region for catalyst grains of both irregular and cylindrical shapes were measured in a differential reactor with gas recirculation. Experimental effectiveness factors were determined from the reaction rates measured in the kinetic region and in the region of internal diffusion. Experiments confirmed the results of theoretical calculations in the preceding communication. The ratio of the tortuosity factor to the constriction factor is in the range 1.5 to 2 for the catalyst under study, in accord with literature data for nontableted catalysts. (Author abstract modified)

4776 APTIC NUMBER 14260

Kadlec, B. and A. Regner
OXIDATION OF SULPHUR DIOXIDE ON VANADIUM CATALYST IN THE REGION OF INTERNAL DIFFUSION. I. THEORETICAL PART. Collection Czech. Chem. Commun. (Prague), 33(8):2388-2396, 1968. 17 refs.

Basic balance relations for mass and heat transfer in spherical catalyst particles were derived on the assumption that the kinetics of oxidation of sulfur dioxide can be described by an equation. Based on a theoretical calculation of the effectiveness factor for both isothermal and nonisothermal cases, an equation is proposed which describes the course of the reaction in the region of internal diffusion. (Author abstract modified)

4777 APTIC NUMBER 14244

Kepinski, J. and K. Kalucki
THE KINETICS OF THE ABSORPTION OF CHLORINE DIOXIDE IN WATER. Intern. Chem. Eng., 5(3):524-532, July 1965. 9 refs. (Also: Chem. Stosowana, no. 4B:467-488, 1964).

Equations for determining mass-transfer coefficients for the absorption of aqueous chlorine dioxide in a packed column of Raschig rings were derived from the following experimental measurements: flow rate of gas entering the chlorine dioxide generator, the flow rate of water fed to the absorption column, the chlorine dioxide and chlorine concentrations at the inlet and outlet of the absorption column, the ClO2 concentration in the solution leaving the absorption column, absorption temperature, and height of packing. Formulas are shown for calculating the total mass-transfer coefficient, the driving force of absorption at column inlet or outlet, and the partial pressure of ClO2 above the aqueous chlorine dioxide solution. The total mass-transfer coefficient is composed of two partial pressure mass-transfer coefficients, one for the liquid phase and one for the gaseous phase. The former is determined as a function of mass velocity of liquid and ratio of the packing bed to the diameter of the packing elements; the latter is a function of the mass rate of the flow of gas and ratio of the packing bed to the diameter of the packing elements. Equations for calculating liquid phase coefficients apply to several Raschig ring sizes under a variety of operating variables.

4778 APTIC NUMBER 14071

Ketov, A. N. and V. V. Pechkovskiy
REACTION OF SULFUR DIOXIDE WITH CALCIUM OXIDE AND CALCIUM CARBONATE. (O vzaimodeystvii sernistogo angidrida s okis'yu i karbonatom kal'tsiya). Text in Russian. Zh. Prikl. Khim., 31(12):1783-1787, 1958. 8 refs.

Results from laboratory studies of the reaction of SO2 with CaO and CaCO3 at 400-1000 C are presented. The main product in the reaction with CaO at 400 C is CaSO3, CaSO4 content increasing with reaction temperature; above 800 C, the CaS content decreases. Increasing the reaction time beyond 15 minutes had little effect on the degree of sulfuration. In both reactions, the ratio of CaSO4 to S2 in the reaction products remains nearly constant at about 4. Calcium carbonate begins to react at 500 C, degree of sulfuration increasing with temperature. It is noted that reaction rate increases sharply above 600 C. Calcium sulfate is seen as the only stable product in both reactions, decomposition of CaCO3 and sulfuration of CaO by SO4(2-) being intermediate steps. The main reactions are the following: CaO plus SO2 yields CaSO3; CaSO3 plus SO2 yields 2CaSO4 plus 0.5S2; 2CaO plus 1.5S2 yields 2CaS plus SO2; CaSO4 plus S2 yields CaS plus 2SO2; and CaS plus 2SO2 yields CaSO4 plus S2. The absence of oxygen in SO2 gas and impurities in the solid phase are assumed.

4779 APTIC NUMBER 14122

Kirsch, A. A. and N. A. Fuchs
INVESTIGATIONS IN THE FIELD OF FIBROUS AEROSOL FILTERS. FLOW RESISTANCE OF MODELS CONSISTING OF PARALLEL CYLINDERS. (Issledovaniya v oblasti voloknistykh aerozol'nykh fil'trov. Soprotivleniye sistem parallel' nykh tsilindrov). Text in Russian. Kolloidn. Zh., 29(5):682-686, 1967. 7 refs.

Hydrodynamic resistance of fibrous filter models consisting of rows of parallel cylinders arranged perpendicularly to the flow was measured in the viscous liquid at low Reynolds numbers. The resistance of models with the even parallel arrangement of all cylinders and that of separate rows of parallel cylinders is in good accord with the theoretical formula of Kuwabara. In such cases, when the parallel arrangement of separate lines or in one and the same line is not observed, or when the evenness of the cylinder arrangement in the rows is broken, the resistance of models appreciably decreases. (Author summary modified)

4780 APTIC NUMBER 14237

Kisza, A.
PERMITTIVITIES AND DIELECTRIC ABSORPTIONS IN TWO FUSED-IONIC-SALT LIQUIDS. J. Chem. Phys., 47(6):2196-2197, 1967. 4 refs.

The difficulty in determining the dielectric constant of a fused salt system lies in the very large low frequency conductance. The dielectric properties of fused lithium-sodium-potassium nitrate at 148 C and fused cadmium-dimethylammonium chloride at 120 C were determined by the Little and Roberts-von Hippel standing-wave methods at frequencies above 250 MHz. The significantly small total loss factors obtained experimentally show that at 900 MHz, low frequency conductance is essentially eliminated, i.e., conductance passes beyond the range of the frequency dispersion of the conductance process.

4781 APTIC NUMBER 14081

Kleinerman, Jerome and C. Richard Cowdrey
THE EFFECTS OF CONTINUOUS HIGH LEVEL NITROGEN DIOXIDE ON HAMSTERS. Yale J. Biol. Med., 40(5-6):579-590, April-June 1968. 11 refs.

In an attempt to experimentally produce emphysema lesions by exposure to nitrogen dioxide, the experimental design of earlier studies was altered so that the previously untested Syrian hamster species could be continuously exposed (20 to 22 hrs/day) for a prolonged period to concentrations of NO2 sufficiently high to produce a moderate mortality (45-55 ppm). Experimental findings are presented. While the size of the alveolar spaces appeared enlarged in the exposed animals compared to the controls, there was no evidence of destruction of alveolar septal tissue, leading to the conclusion that a tissue-destructive form of emphysema was not produced in this experiment. The use of continuous exposures for prolonged periods, even at concentrations that produce a mortality of approximately 35%, does not appear to alter the nondestructive character of the tissue response. The hamster thus joins the other rodent groups previously studied, by these authors as species that respond characteristically to NO2 inhalation by an exudative and proliferative reaction without evidence of tissue destruction. The character and degree of the epithelial and inflammatory response appear similar in kind and proportional in extent to the time concentration product imposed. The variability in the response among bronchioles in a single lung is seen as even more disquieting than the differences in degree of reaction among animals similarly exposed, suggesting that profound differences in the uniformity of distribution of the inhaled noxious agent exist. These observations are consistent with physiological observation, but their fundamental basis remains unclear. The rapid and almost complete involution of the epithelial hyperplastic and inflammatory response produced by NO_2 in the animals studied 30 days after cessation of exposures is considered remarkable and is thought to demonstrate the extensive reparative properties of the lung. The return toward normal of the lung volumes and right ventricular weights in this group again suggests that a reversible lesion is being repaired and lends support to the conclusion that no permanent tissue destruction has been produced by these profound experimental exposures. Two factors are discussed as possible causes of apparent differences between these results and those of other investigators carrying out similar experiments: the use of varying definitions of the term emphysema and varying techniques to inflate and fix lung tissue. A record of a discussion of this paper is included.

4782

APTIC NUMBER 14240

Kleppa, O. J. and S. V. Meschel
THERMOCHEMISTRY OF ANION MIXTURES IN SIMPLE FUSED SALT SYSTEMS. I. SOLUTIONS OF MONOVALENT CHLORIDES AND BROMIDES IN THE CORRESPONDING NITRATES. J. Phys. Chem., 67(3):668-671, March 1963. 11 refs.

Calorimetric measurements were performed on the heats of solution and dilution for monovalent chlorides and bromides in the corresponding liquid nitrates. All the alkali halide-alkali nitrate systems studied exhibited small positive enthalpies of mixing, with the largest effects observed for the sodium systems. Results are explained in terms of the short range repulsive potential between the ion cores, particularly the anion-anion (i.e., second nearest neighbor) core repulsion. This interpretation, which is essentially equivalent to the 'packing effect' interpretation advanced by Flood for bromide-chloride melts, is related to the size relations between anions and cations in the anion mixtures considered. Since the anions are not well separated, the mixing process is assumed to be associated with an appreciable volume expansion. Because these excess volumes increase sharply with increasing difference in size between the cations, it is concluded that a small positive packing effect may be present even in the simple cation-cation mixtures. Data showing the decrease in interaction parameter with increasing radius ratio from sodium up, and the extensive similarity between the values for the chloride-nitrate and bromide-nitrate systems, offer strong support for the second nearest neighbor interaction concept. Decreases in interaction parameters from sodium to lithium are explained by structural differences between liquid silver and thallium salts and by chemical interaction in the mixture. Departures from ideality in these systems reflect the breakdown of the second nearest neighbor approximation.

4783

APTIC NUMBER 14147

Komatsu, W., H. Ooki, I. Naka, and A. Kobayashi
SYNERGETIC EFFECT OF OXIDE CATALYSTS WITH DIFFERENT DOPENTS ON CATALYTIC ACTIVITY. I. NICKEL OXIDE AND ZINC OXIDE FOR CARBON MONOXIDE OXIDATION. J. Catalysis, 15(1):43-49, Sept. 1969. 19 refs.

Carbon monoxide oxidation was investigated over doped and undoped nickel oxide and zinc oxide catalysts and mixed catalysts containing $NiO-Li_2O$ and $NiO-In_2O_3$ or $ZnO-Li_2O$ and $ZnO-In_2O_3$. On nickel oxide catalysts, the rate of CO oxidation was first order with respect to the partial pressure of carbon monoxide. With indium oxide-doped nickel oxide, the first order equation did not express the high conversion data. Surface area measurements show that the areas of both nickel oxide and zinc oxide are decreased by doping with lithium ions and increased by incorporation of indium ions. This suggests that the sintering of nickel oxide and zinc oxide is controlled by the diffusion of electron holes, e.g., Ni(3 plus) ions and interstitial zinc ions, respectively. Incorporation of indium ions enhances the activity of a catalyst and incorporation of lithium ions suppresses activity. Activation energies for mixed catalysts are lower than for single catalysts and, consequently, the activities of mixtures are greater. The mechanism of the increased activity of mixtures is discussed in terms of the synergetic action of doped catalysts with different Fermi levels.

4784

APTIC NUMBER 14234

Kozlowski, T. R. and R. F. Bartholomew
REACTIONS BETWEEN SODIUM CARBOXYLIC ACID SALTS AND MOLTEN SODIUM NITRATE AND SODIUM NITRITE. Inorg. Chem., 7(11):2247-2254, Nov. 1968. 15 refs.

Results obtained from the infrared analysis of the reaction of $NaCOOH$ in $NaNO_3$ and $NaNO_2$ and the reaction of $NaC_2H_3O_2$ in $NaNO_3$ and $NaNO_2$ were confirmed by voltammetric, cyromscopic, and chronopotentiometric determinations. Sodium carbonate, $NaNO_2$, N_2O, H_2O, and CO_2 are formed by the reaction of $NaCOOH$ in $NaNO_3$ but only N_2O, H_2O, and Na_2CO_3 by the reaction of $NaCOOH$ in $NaNO_2$. The relatively low level of N_2O in the product gases indicates that the following reactions occur simultaneously in the melt: $NaCOOH$ plus $NaNO_3$ yields $NaNO_2$ plus 1/2Na_2CO_3 plus 1/2H_2O plus 1/2CO_2 and $NaCOOH$ plus $NaNO_2$ yields Na_2CO_3 plus 1/2N_2O plus 1/2H_2O. These equations represent the overall reactions of sodium formate in the melt. The total moles of cryoscopic particles formed in the melt are the sum of contributions of $NaNO_2$ and Na_2CO_3. The products from the reaction of $NaC_2H_3O_2$ with $NaNO_3$ are Na_2CO_3, $NaNO_2$, CO_2, and N_2O; the reaction products of $NaC_2H_3O_2$ in $NaNO_2$ are Na_2CO_3, H_2O, and N_2O. The reaction of acetate in nitrite constitutes the source of nitrogen in both nitrate and nitrite melts, suggesting the following reaction schemes: $NaC_2H_3O_2$ plus 4$NaNO_3$ yields 4$NaNO_2$ plus 1/2Na_2CO_3 plus 3/2CO_2 plus 3/2H_2O and $NaC_2H_3O_2$ plus 3$NaNO_2$ yields 2Na_2CO_3 plus 3/2H_2O plus 1/2N_2O plus N_2. Both formate and acetate react with nitrate and nitrite at temperatures near the boiling point. The formation of nitrite as a reaction product in the nitrite melts results in a competition for additional carboxylic acid. The reactions with formate are more rapid than those with acetate, and caution is recommended in studying these systems.

4785 APTIC NUMBER 14114

Krause, A.
THE CATALYSED REACTION BETWEEN COS AND SO2. (Die katalysierte Reaktion zwischen COS und SO2). Text in German. Bull. Acad. Polon. Sci., Ser. Sci. Chim., 8(8):439-440, 1969. 3 refs.

The reaction mechanism between COS and SO2 on an Fe2O3 catalyst is discussed. Due to the anionic properties of the catalyst, SO2 is chemisorbed and activated. In this state, SO2 readily absorbs the oxygen of COS. The highly reactant CS radical develops and triggers a chain reaction by itself without the catalyst. The activated SO2 is oxidized to SO3, which is less prone to react with the catalyst. This might lead to either direct separation of SO3 or to adhesion of SO3 to the catalyst by formation of an alkaline ferric sulfate. The latter subsequently dissociates at a temperature of 600 to 800 C by liberating SO3. Thus, free sulfur trioxide develops in any case. As a strong oxidant, it exerts its influence on each new COS molecule independently of the catalyst, i.e., it triggers a second chain reaction in this system. Some of the reactions are as follows: 2SO3 yields 2SO2 plus O2; SO3 plus COS yields CO2 plus SO2 plus 1/2S2; SO2 plus equal CS yields CO2 plus S2; and O plus COS yields CO2 plus 1/2S2.

4786 APTIC NUMBER 14088

Kubota, H., S. Namkoong, T. Akehata, and M. Shindo
OPTIMUM PROCESS CONDITIONS FOR A COMPLETELY MIXED MULTISTAGE REACTOR. Can. J. Chem. Eng., vol. 39 to 41:64-66, April 1961. 6 refs.

A graphical method is described for determining optimum process conditions for a multistage, completely mixed chemical reactor and the minimum catalyst volume at a given outlet conversion. The derivation assumes continuous flow from stage to stage, complete mixing within each stage, and individual temperature control within each stage. The method is illustrated by application to sulfur dioxide oxidation in a multistage fluidized catalyst bed.

4787 APTIC NUMBER 14055

Kurin, N. P. and I. O. Blokh
CATALYTIC OXIDATION OF NITRIC OXIDE. PART I. (Kataliticheskoye okisleniye okisi azota. Soobshcheniye I). Text in Russian. Zh. Prikl. Khim., 11(5):734-749, 1938. 10 refs.

Experimental study of three materials is reported: silica gel, vanadium catalyst used in the contact method of nitric acid production, and chromium-zinc catalyst used in methanol synthesis. These catalysts were used to oxidize NO to NO2 with a volumetric flow rate of 200-600 per hour at 25-200 C. The incoming gas was dried over concentrated sulfuric acid and had the following composition (vol %): NO, 3.0; O2, 7.8; atmospheric nitrogen, balance. Catalytic action occurred in all cases, total degree of oxidation decreasing with increased flow rate. As the temperature increases above 200 C, reaction rate decreased (greatest decrease with silica gel). Silica gel was found to be the best catalyst for temperatures up to 100 C. In the 150-200 C range, silica gel and vanadium catalyst were comparable, both being more active than the chromium-zinc catalyst. Rate equations are given. The apparent energies of activation for these catalysts are 4700, 1860 and 340 cal/mole.

4788 APTIC NUMBER 14229

Kust, R. N.
A STUDY OF DIMOLYBDATE AND DICHROMATE FORMATION IN FUSED EQUIMOLAR SODIUM NITRATE-POTASSIUM NITRATE SOLVENT. Inorg. Chem., 6(12):2239-2243, Dec. 1967. 12 refs.

An electrochemical investigation of the dimerization of orthomolybdate, MoO4(2-), and orthochromate, CrO4(2-), is reported. When small amounts of the orthooxy anions were added to an equimolar sodium nitrate-potassium nitrate solvent, the potential of the electric cell increased. When the oxygen electrode potentials were plotted as a function of total molybdate concentration at several temperatures, straight lines were obtained whose slopes indicat that the oxide ion concentration is proportional to electrochemical cell potential. Similar lines were obtained for the chromate system. When small quantities of dimolybdate or dichromate were added to the melt after several first additions of the respective orthooxy anions, the potential of the electrode system decreased, indicating a disappearance of the oxide ion. The slopes of lines obtained by plotting electrode potential against total molybdate concentration at different temperatures indicate that the oxide ion concentration is inversely proportional to dianion concentration. Further addition of orthooxy anions caused electrode potential to increase in a different manner: the oxide ion concentrations varied as the square of the total orthooxy anion concentration. Dependence of electrode potential on concentration of the orthooxy anion and the dianion cannot be explained by the simple dissociation of the orthooxy anion into the metallic trioxide, MO3, and the oxide ion. Experimental data indicate that dimolybdate and dichromate formation involve a condensation leading to a higher polymeric species. Selected values are given for the equilibrium 2MO4(2-) constants of M2O7(2-) plus O(2-). Changes in enthalpy and entropy values are discussed.

4789 APTIC NUMBER 14233

Kust, R. N.
CARBONATE ION DISSOCIATION IN FUSED ALKALI NITRATES. Inorg. Chem., 3(7):1035-1036, July 1964. 7 refs.

The equilibrium constant for the dissociation of carbonate ion in fused equimolar sodium-potassium nitrate solvent, according to the equilibrium reaction CO3(2-) yields CO2 plus O(2-), was determined potentiometrically with an oxygen-platinum indicator electrode in conjunction with a silver-silver nitrate reference electrode. Values of the dissociation constant were (3.9 plus or minus 0.5) x 10 to the minus sixth power at 523 K and 5.6 plus or minus 0.2) x 10 to the minus fifth power at 580 K. Standard enthalpy and entropy changes for the dissociation were constant over the temperature range studied and were found to be 27.0 plus or minus 0.1 kcal and 27.1 plus or minus 1 e.u., respectively. Values for the Gibbs function at 523 and 573 K are 12.9 plus or minus 0.1 and 11.5 plus or minus 0.1 kcal, respectively. From the magnitude of the observed values for the equilibrium constant, it is concluded that the nitrate solvent provides a stabilizing environment for the products of the dissociation reaction, with the O(2-) ion offering the greatest possibilities for reaction with the solvent. One such stabilizing reaction would be the formation of the orthonitrate ion NO4(3-), according to the equilibrium reaction O(2-) plus NO3(-) yields NO4(3-). (Author abstract modified)

4790 APTIC NUMBER 14182

Kust, R. N.
THE OXYGEN ELECTRODE IN FUSED ALKALI NITRATES. J. Phys. Chem., 69(10):3662-3663, Dec. 1965. 5 refs.

The chemical addition of oxide ion to an equimolar sodium-potassium nitrate melt is complicated by the insolubility of most metallic oxides. Also, the introduction of cations different from the solvent cations would lead to possible complex formation, the formation constants of which would be unknown. Hence, one is limited to either Na2O or K2O as a source of oxide ion, but it is very difficult to prepare either of these oxides so that they are free from peroxide and superoxide contaminants. However, other studies have shown that sodium carbonate has an unusually large dissociation constant in this solvent in the temperature range of interest. The dissociation constant for the reversible reaction CO3(2-) yields CO2 plus O(2-) is on the order of 0.00001 at 300 deg. Thus, the addition of Na2CO3 to the solvent and the subsequent removal of the CO2 produced is equivalent to the addition of Na2O directly; also, no contamination by peroxides or superoxides is likely to occur. A comparison of the standard electric field strength values obtained in this manner to the values obtained by the coulometric generation of oxide ion is given. In every case, the difference between the two values was 0.3 mv or less. With these additional data, the oxygen electrode is judged to be sufficiently defined to be a useful electrode for electrochemical studies in alkali nitrate solvents.

4791 APTIC NUMBER 14281

Laitinen, H. A. and I. M. Kolthoff
A STUDY OF DIFFUSION PROCESSES BY ELECTROLYSIS WITH MICROELECTRODES. J. Am. Chem. Soc., 61(12):3344-3349, Dec. 1939. 9 refs.

The diffusion of an electro-oxidizable or reducible substance in solution can be studied by measuring the current obtained using suitable electrodes in an electrolytic cell if the supply of electro-reducible or oxidizable material is determined only by the rate of diffusion of the material to one of the electrodes, and if well-defined boundary conditions of concentration can be maintained at the electrode surface. The theory of the diffusion process in the vicinity of an electrode depends upon the geometric characteristics of the electrode and the surrounding solution. The equations for the current as a function of time and for linear and spherically symmetrical diffusion are given. Eight platinum electrodes of various shapes were constructed. The experiments were run by applying a constant potential to the microelectrode. This potential corresponded to a point near the middle of the diffusion current region of the electrolytic process as determined from a current-voltage curve obtained with the platinum wire microelectrode. Current-time curves with various shapes of electrodes and diffusion fields in the electrooxidation of ferrocyanide ions were determined, and the condition under which theoretical diffusion conditions can be obtained are discussed. Theoretical conditions were not obtained with spherically symmetrical diffusion in aqueous solution but were approached in 3% agar and in 4% gelatin gels. With linear diffusion in such a direction as to produce a density gradient in the downward direction, the quantity of a constant which is calculated from the concentration, the diffusion coefficient of the electroactive substance, and the area of the electrode, was found to be constant to 0.5% over a period of 20 min. The temperature coefficient of the same constant was found to be in agreement with the calculated value.

4792 APTIC NUMBER 14313

Lederer, E. L.
VERIFYING ADSORPTION FORMULAS BY MEANS OF ADSORPTION MEASUREMENTS WITH ACTIVATED CHARCOAL. (Pruefung von Adsorptionsformeln an Hand von Adsorptionsmessungen bei einer hochaktiven Kohle). Text in German. Kolloid-Z. (Stuttgart), 61(3):323-328, 1932. 15 refs.

Data reported by Remy on the adsorption of gases and vapors on activated charcoal were used to verify isothermal and isobaric adsorption laws. In the isothermal case, no decision can be made between a logarithmic law and the formula of Langmuir. In the isobaric case, a logarithmic law seems to fit the results best. The isosteric curve of Trouton and Poole and the relationship of Gurwitsch fit the data only moderately well. The relationship between the vapor pressure and the adsorbed volume of various gases indicates that equal amounts of different gases are adsorbed, referred to corresponding states. Gas mixtures are adsorbed proportionally, provided the concentrations are modified by the influence of the mean molecular velocities and the shape of the molecules. The adsorption data for the following gases were used: CO2, N2O, HCl, H2S, NH3, Cl2, CH3Cl, SO2, CH4, and COCl2.

4793 APTIC NUMBER 14251

Leva, Max, Milton Grummer, Murray Weintraub, and Morris Pollchik
INTRODUCTION TO FLUIDIZATION. Chem. Eng. Progr., 44(7):511-520, 1948. 6 refs.

Counter-gravity flow of air, carbon dioxide, and helium through beds of round and sharp silica sands was investigated. As long as bed expansion does not occur, counter-gravity flow does not differ from cogravity flow. Correlations were developed which permit the prediction of the fluid velocity necessary to expand a bed of sand under counter-gravity flow conditions. Correlations include a shape factor, and typical photographs of the various sizes and shapes of sand permit comparison of new materials with those tested. In this way, approximate shape factors of new and similar materials can be satisfactorily determined. The proposed equations apply to narrow cuts as well as to mixtures where particle diameter is defined according to the rule suggested. The most complex mixture investigated was composed of five individual elements. It is believed that the correlations apply also to more complex mixtures. Fluidization phenomena in a 2-1/2 and 4-in. glass tube are discussed and possible explanations are proposed for the slugging and channeling behavior of fluidized beds. (Author summary modified)

4794 APTIC NUMBER 14089

Leva, Max
VARIABLES IN FIXED BED SYSTEMS. Chem. Eng., vol. 64:263-266, Aug. 1957. 4 refs.

Pressure drop through a packed-bed system is highly sensitive to voidage, which in turn is directly related to bed intensity. The condition of particle surface and particle shape are shown to affect packing density. For example, particles with an appreciable surface roughness have a tendency to bridge while falling, thereby forming a looser and less homogeneous bed in the reactor. Irregularly shaped granules will produce a bed of higher voidage than more rounded granules. Similarly, cylinders of 1:1 ratio of height to diameter give a denser bed than more slender cylinders. Finally, mixtures of a certain species of particles produce denser beds than uniformly sized particles. Granule beds exhibit the highest voidages, the highest surface areas, and the lowest relative pressure drop. It is suggested that packed-bed voidage be considered in deriving expressions for the space velocity that serves to indicate contact time of a feed in the bed. The calculation of particle shape and friction factors is considered.

4795 APTIC NUMBER 14284

Lightfoot, E. N.
STEADY STATE ABSORPTION OF A SPARINGLY SOLUBLE GAS IN AN AGITATED TANK WITH SIMULTANEOUS IRREVERSIBLE FIRST-ORDER REACTION. A.I.Ch.E. (Am. Inst. Chem. Engrs.) J., 4(4):499-500, Dec. 1958. 6 refs.

The mass transfer coefficients are commonly calculated by assuming steady state physical absorption into a liquid containing no dissolved gas. This calculation is reliable only if the chemical reaction is fast enough to maintain the concentration of the dissolved gas near zero in the bulk of the solution but slow enough not to affect the concentration near the surfaces of dissolving gas bubbles. A clearer understanding of the conditions required for the validity of the calculation method was obtained by analysis of relatively simple model systems. This was done for first-order removal of dissolved gas and for two common models, absorption according to Higbie's theory of penetration into bubbles with intenal gas circulation and absorption through a hypothetical stagnant film of definite thickness completely surrounding the bubble. Equations for the models are given.

4796 APTIC NUMBER 14023

Linek, J. and E. Hala
LIQUID-VAPOUR EQUILIBRIUM IN SYSTEMS OF ELECTROLYTIC COMPONENTS. IV. THE SYSTEM K_2O-SO_2-H_2O AT 60, 70, 80 AND 90 C. Collection Czech. Chem. Commun. (Prague), 32(11):3817-3831, 1967. 10 refs.

Vapor-liquid equilibria were measured by the saturation method for the system K_2O-SO_2-H_2O at 60, 70, 80, and 90 C over a range of concentrations of practical interest for the regeneration of potassium in the manufacture of terephthalic acid from potassium benzoate. For each composition of the solution, two determinations of partial pressure were made at each temperature. Almost all the pairs of values obtained are in good agreement, differing from the mean value by less than 0.3%. The dependence of partial pressures of sulfur dioxide and water on the temperature and composition of the liquid phase is expressed by thermodynamically consistent equations. (Author abstract modified)

4797 APTIC NUMBER 14231

Liteanu, C. and E. Cordos
ON A NEW PROCESS FOR THE PREPARATION OF SULFUR DIOXIDE FROM CALCIUM SULFATE. I. THE SYSTEM NACL-$CASO_4$. (Sur un nouveau procede de preparation du bioxyde de soufre en partant du sulfate de calcium. I. Le systeme NaCl-$CaSO_4$). Text in French. Rev. Roumaine Chim. (Bucharest), 12(8):985-988, Aug. 1967. 3 refs.

The preparation of sulfur dioxide by the electrolytic decomposition of calcium sulfate in a molten mass of sodium chloride is reported. When the process is carried out at temperatures above 740 deg, gases with a sulfur content of 45-50% are obtained from the anode and a 1:4 mixture of CaS and CaO from the cathode with a yield of current of 85%. In contrast to the thermal process for preparing sulfur dioxide from gypsum, the gases produced by electrolysis are very concentrated and dust-free. These advantages could lead to the eventual technological application of the method.

4798 APTIC NUMBER [illegible]

Littlewood, R.
A REFERENCE ELECTRODE FOR ELECTROCHEMICAL STUDIES IN FUSED ALKALI CHLORIDES AT HIGH TEMPERATURES. Electrochim. Acta, vol. 3:270-278, 1961. 10 refs.

A reference electrode based on the reversible silver to silver-chloride reaction was developed for use in fused halide systems.

A reference electrode for this work must be reproducible to within better than plus or - 10 mV, must maintain constant e.m.f. over long periods in fused alkali chlorides at 700 C, must be unaffected by freezing and remelting of the electrolyte, must not contaminate the external melt, since the electrolyte junction is a glass sheath 1 mm thick, and must be robust and survive solidification of the melt. Deviation from the Nernst equation was found and was due to a junction potential across the glass sheath, for which quantitative corrections can be calculated. The transport number of the silver ion is negligibly small at 700 C. A reference electrode with an electrolyte concentration of 0.271 AgCl mole fraction in an equimolar NaCl-KCl mixture has a potential of -939 mV with respect to the standard chlorine electrode at 700 C. The reference electrode described is reversible and its potential is table and reproducible. This indicates that both the electrode potential and junction potential are likewise stable and reproducible. The electrode represents an advance on those electrodes which rely on a porous barrier for electrical contact, in that contamination of the external environment by electrolyte is negligible. The glass sheath gives rise to a well-defined junction potential, which can be reasily calculated. The electrode is much less fragile (it does not disintegrate on solidification of the melt) and can be used in fused chlorides at temperatures up to at least 750 C.

4799 APTIC NUMBER 14136

Littlewood, R. and E. J. Argent
ELECTROCHEMICAL STUDIES OF THE BEHAVIOUR OF METALS IN FUSED CHLORIDES. Electrochim. Acta, vol. 4:155-169, 1961. 10 refs.

Results are presented of a preliminary study of the electrode potential behavior of reactive metals in equimolar NaCl-KCl melts at 700 C under argon, with particular reference to nickel and iron; several experiments on polarization behavior are also included. During the equilibration of a metal with a fresh melt, the redox potential of the melt falls and the Nernst potential of the metal rises until the two become identical and the metal becomes immune. The rate at which this occurs was found to depend on the impurity content of the melt and the ratio of metal surface area/volume of melt. The kinetics were shown to be determined largely by diffusion processes. Contamination of the melt by contact with silica slowed down the equilibration process; oxide corrosion products were usually found in the melts. In chloride melts containing NaNO3, iron showed a tendency to passivate, but stable passivity, such as is found in pure nitrate melts, could not be reproduced in melts containing up to 0.1 mole fraction NaNO3. No signs of passivity were found in a nitrate-free melt in contact with air for either Fe or Ni. It is concluded that the safest way to avoid corrosion in fused chlorides, particularly with the relatively noble metals Fe and Ni, is to aim at immunity. The degree of purity of melt necessary to reach immunity in a reasonable time was shown with NaCl-KCl to be attained simply by vacuum fusion, provided contact with silica is avoided, and under these conditions relatively little corrosion occurs before immunity is attained. Obviously, once immunity is achieved, stringent precautions have to be taken to prevent ingress of oxidizing impurities, but if traces are introduced accidentally, the condition can be re-established by the same mechanism although at a slightly higher level of contamination by metal ions. (Author abstract modified)

4800 APTIC NUMBER 14132

Littlewood, R. and E. J. Argent
THE EFFECT OF AQUEOUS CONTAMINANTS ON THE REDOX POTENTIAL OF CHLORIDE MELTS. Electrochim. Acta, vol. 4:114-128, 1961. 8 refs.

The redox potential of a chloride melt contaminated with water is determined by the activities of its hydrolysis and dissociation products i.e., hydrogen ions, oxide ions, hydrogen, and oxygen. The effects of the changes in these products were studied by changing the partial pressures of HCl, H2, or O2 above the melt or by adding Na2O to the melt. Experiments were carried out in equimolar NaCl-KCl at 700 C. Variations in O2 partial pressure did not change the activity of the oxide ions. Stable redox potentials could not be obtained under low pressures of hydrogen. This suggested that under low pressures of hydrogen, the hydrogen-ion activity was continually rising. The effect of hydrogen-ion concentration suggests that true equilibrium of the melt with the gas phase was not obtained, and the measured potentials are a kinetic compromise between the composition of the gas phase and the equilibrium redox potential of the melt. The effect of oxygen-ion concentration indicated that changes in redox equilibria in the melt were occurring. The study indicated that attempts to change activity of one component of the melt by altering the composition of the gas phase or by making additions to the melt have brought about changes in the position of equilibria in the melt. Control of oxygen pressure would therefore be a definite way of controlling redox potentials of chloride melts, since the changes in redox potential could be accurately forecast. Hydrogen under low pressures corroded in the same way that a metal attempts to approach thermodynamic equilibrium in the melt by contaminating it with metal ions and ultimately becoming immune. The occurrence of this effect meant that attempts to reduce redox potential of a melt by varying hydrogen pressure would not be as good a control as varying oxygen pressure. The upper limit of the range of redox potential over which platinum behaved as a redox electrode was found to be - 0.4V on the standard chlorine electrode scale.

4801 APTIC NUMBER 14151

Liu, C. H.
ELECTRODE POTENTIALS IN MOLTEN LITHIUM SULFATE-POTASSIUM SULFATE EUTECTIC. J. Phys. Chem., 66(1):164-166, Jan. 1965. 11 refs.

The lithium sulfate-potassium sulfate eutectic (80% lithium sulfate by mole; melting point 535 deg) was shown to be an adequate molten solvent for electrochemical investigations at 625 deg. A procedure for preparing the eutectic melt was established. The silver(I)-silver(0) system was found to be a satisfactory reference electrode in this melt. The electrode systems, whose standard potentials were measured by direct potentiometry against the silver reference, are: copper(I)-copper(0), copper(II)-copper(I), palladium(II)-palladium(0), and rhodium(III)-rhodium(0). The Nernst equation was applicable in all cases.

This eutectic mixture was found to be easy to prepare and convenient to handle compared with the halide melts in the same temperature range; however, its potential span is much shorter than the alkali chloride melts. The more active metal electrodes were considered to be less convenient to study because of chemical reduction of sulfate; for example, nickel was observed to react with the melt to form nickel sulfide. Bismuth(III) was observed to exhibit the tendency of some metal ions to precipitate as their oxides, releasing sulfur trioxide. Thus, competing acid-base equilibria also play an important role in molten sulfates.

4802 APTIC NUMBER 13981

Lyakhovskiy, D. N.
CONVECTIVE HEAT EXCHANGE BETWEEN A GAS AND SUSPENDED PARTICLES. (Konvektivnyy teploobmen mezhdu gazom i vzveshennymi chastitsami). Text in Russian. Zh. Tekhn. Fiz., 10(12):999-1013, 1940.

A method was developed for experimentally determining convective heat transfer to particles suspended in a gas. A generalized formula for the coefficient of heat transfer was derived from experimental data for Reynolds numbers of 8 to 30,000. This formula is suitable for designing the thermal working (drying, roasting, melting, gasification, combustion) of materials in suspension. The effect of flow turbulence on the coefficient of heat transfer is found to be insignificant. Experiments made with dust (corundum, glass, chamotte; particle size: 0.161-0.784 mm) under free-fall conditions in stationary air, and metal spheres (mercury, diam - 3.00 and 3.80 mm; lead, diam - 1.37 and 1.46 mm; steel, diam - 3.17 mm) falling at equilibrium rate in hot water are described in detail. The coefficient of heat transfer due to convection was also determined experimentally by transient heating of fixed metal spheres by a heated flow of air of various turbulence. Experimental data yielded a Nusselt number equal to 0.62 times Re to the 0.5 power (for Reynolds numbers of 150 to 30,000).

4803 APTIC NUMBER 14146

McCaa, David J. and Dietmar E. Rothe
EMISSION SPECTRA OF ATMOSPHERIC GASES EXCITED BY AN ELECTRON BEAM. AIAA (Am. Inst. Aeron. Astronaut.) J., 7(8):1648-1651, Aug. 1969. 6 refs.

The molecular gases NO, O2, H2O, CO, and CO2 were excited by electron beam techniques to study their interaction with the N2(plus)(1-) spectrum from 2800 to 6600 A and at 10 to 100 micron pressures. The intensity of the nitrogen fluorescence spectrum exceeds that of any other system observed. Spectra of N2, O2, CO, and CO2 are composed of molecular ion bands with some atomic lines present, while the spectra of NO, H2, and H2O consist primarily of atomic lines. Atomic lines follow a linear intensity dependence with pressure. The molecular ion bands, with the exception of N2(plus) exhibit quenching at higher pressures, the pressure at which quenching becomes significant varying among gases. Relatively strong self-quenching was observed for the first negative system of O2(plus), for the comet tail system of CO(plus), and for the Fox, Duffendack, and Barker system of CO2(plus). Characteristic self-quenching pressures for these systems appear to be 50, 20, and 150 microns Hg, respectively. Strong relative enhancement of neutral CO bands by secondary electrons was found at higher pressures. At gas pressures below 100 microns, the intensity of the N2(plus)(1-) system is not severely affected by the presence of O2, H2, H2O, or CO. (Author conclusions modified)

4804 APTIC NUMBER 14131

McKenzie A. and B. A. Thrush
THE KINETICS OF ELEMENTARY REACTIONS INVOLVING THE OXIDES OF SULPHUR. IV. THE FORMATION OF ELECTRONICALLY EXCITED SULPHUR DIOXIDE ON SURFACES. Proc. Royal Soc. A, 308(1492):133-140, Dec. 17, 1968. 11 refs.

The intensity of the sulfur dioxide afterglow arising from the chemiluminescent combination of oxygen and sulfur oxide has been studied in a flow system down to 10 micrometers Hg pressure. The spatial distribution of the visible and nearest ultraviolet part of the afterglow was determined by photographing the emission normal to the tube flow. The emission spectrum obtained from O and SO at a total pressure of 11.6 micrometers Hg shows banded emission by the 1B1 and 3B1 states of SO2 which originates below the predissociation limits for O and SO. This emission is more similar to the spectrum of the chemiluminescent reaction than to the sulfur dioxide afterglow. The latter shows largely continuous emission between 2240 and 5000 A. In the 1B1 and 3B1 states, molecules form at the surface and diffuse away from it. Their formation is due to a reaction between SO and chemisorbed oxygen atoms, for which a heat of adsorption of 25-30 kcal/mole is deduced. Analysis of the spatial distribution of the visible emission yields a radiative life of 7.5 plus or - 2.0 x 0.0001 for the 3B1 state of SO2.

4805 APTIC NUMBER 14098

Mendez, J., I. J. Gal, and J. W. Irvine, Jr.
THE SOLUBILITY OF SILVER CHLORIDE AND SILVER BROMIDE IN MOLTEN LITHIUM NITRATE-POTASSIUM NITRATE EUTECTIC MIXTURE. Inorg. Chem., 7(7):1329-1332, July 1968. 11 refs.

The solubilities of AgCl and AgBr in molten LiNO3-KNO3 eutectic mixture were measured as a function of temperature and halide ion concentration. The temperature was varied between 150 and 200 degrees and the concentration of halide ion was varied between 0.001 and 0.2 M. All the experiments were carried out in such a way that the equilibrium concentration of the halide ion in the melt was at least five times the concentration of silver remaining in solution. The solubility products of the silver halides and the stability constants of the halide complexes were evaluated. The dependence of the stability constants on temperature followed the generalized quasi-lattice model developed by Blander. The values of the Helmholtz specific molar free energy change for bond formation for the pure LiNO3 melt seem large when compared with those for pure NaNO3 or KNO3. This type of anomalous behavior of the melts containing

LiNO3 was also observed in the formation of other complexes in LiNO3-KNO3 mixtures. These anomalous effects were explained on the basis of a smaller effective radius of the nitrate ion in lithium-containing melts.

4806 APTIC NUMBER 14198

Michalek, Jiri, Antonin Simecek, Bohumil Kadlec, and Milan Bulicka
ADIABATIC MULTISTAGE REACTOR FOR CATALYTIC OXIDATION OF SULPHUR DIOXIDE. I. APPLICATION OF LABORATORY KINETIC DATA TO THE CALCULATION OF MAGNITUDES IN A PACKED REACTOR. (Adiabaticky vicestazovy reaktor pro katalytickou oxidaci kyslicniku siriciteho. I. Pouziti laboratornich kinetickych dat pro vypocet velikosti naplne reaktoru). Text in Czech. Chem. Prumysl (Prague), 19(8):346-349, 1969. 12 refs.

The technological action of an adiabatic reactor for sulfur dioxide oxidation is compared with the action of plant reactors. The packing for a five-stage reactor was calculated. For a known catalyst, it is necessary to determine experimentally at least three isotherms and for an unknown catalyst, 5 to 7 isotherms must be determined experimentally in the kinetic and diffusion regions. The effect of internal diffusion on the rate of the process was taken into consideration when calculating the packing of the individual plates. (Author summary modified)

4807 APTIC NUMBER 14105

Milbauer, Jaroslav and Jaroslav Tucek
STUDY OF THE REACTION R(M)S(N) PLUS 2N(SO2) YIELDS R(M)(SO4)N PLUS NS2. A CONTRIBUTION TO THE CHEMISTRY OF ONE ROASTING. (Ueber die Reaktion RmSn plus 2n(SO2) yields Rm(SO4)n plus nS2. Ein Beitrag zum Chemismus des Roestens einiger Erze). Text in German. Chemiker Ztg. (Heidelberg), 50(48):323-325, April 1926. 26 refs.

The results of studies of reactions of sulfur dioxide with synthesized sulfides as well as with some sulfur ores are briefly summarized. The experiments were performed in a resistance furnace. A porcelain tube containing a porcelain or magnesium boat with a weighed amount of sulfide was inserted into the furnace. Sulfur dioxide was pressed through the tube at constant velocity and the temperature was measured with the Le Chatelier thermocouple. The results show that the synthesized metal sulfides and also simple minerals or ores react according to the equation RmS(n) plus 2n(SO2) yields Rm(SO4)n plus nS2. Mercury sulfide is an exception as it is not subject to any change. With alkaline and alkaline earth sulfides, only sulfates are formed. Aluminum, chromium, zinc, manganese, iron, cobalt, nickel, tin, and cadmium sulfides yield the respective sulfates at temperatures around 500 C when they come in contact with SO2. However, at this temperature the sulfates begin to decompose and oxides develop. With antimony, bismuth, copper, and lead sulfides, elemental sulfur is a product.

4808 APTIC NUMBER 14133

Mills, Elliott and McIver W. Edwards, Jr.
STIMULATION OF AORTIC AND CAROTID CHEMORECEPTORS DURING CARBON MONOXIDE INHALATION. J. Appl. Physiol., 25(5):494-502, Nov. 1968. 23 refs.

In carboxyhemoglobinemia, it is unusually difficult for hemoglobin to give up oxygen to the tissues. Thus, a given decrease in O2 content reduces the oxygen pressure (P(O2)) of the tissues more when blood is carbonylated than when it is not. It was found that aortic and carotid chemoreceptors were always stimulated when anesthetized cats spontaneously breathed 1.0% CO or were ventilated with 0.3% CO in air. The frequency of chemoreceptor impulses when the cats were given CO was compared with that when they breathed air. When the percentage of saturation of hemoglobin with CO reached 18-40%, the impulse frequency was 2-5 times its air control rate. This increase was comparable to that in a 'low O2' control period. When CO was discontinued, the impulse frequency fell toward the control rate as CO saturation fell. The stimulation was not due to low arterial P(O2), to hypertension, or to a direct effect of CO on cytochrome oxidase but was attributed to the decrease in local tissue P(O2) that occurs in carboxyhemoglobinemia. (Author abstract modified)

4809 APTIC NUMBER 14085

Munoz P., E., C. Ruiz M., and M. Riveros R.
DISTRIBUTION COEFFICIENT OF MANGANESE IN SODIUM CHLORIDE CRYSTAL DETERMINED BY ELECTRON SPIN RESONANCE. J. Appl. Physics., 39(8): 3654-3656, July 1968. 8 refs.

The distribution coefficient of divalent manganese in sodium chloride single crystals was determined by ESR spectrometry at room temperature and a wavelength of 3 cm. The crystals were grown from sodium chloride to which manganous chloride tetrahydrate was added in the proportions 0.5 and 1 at.%. Crystallization was accomplished by melting the sodium chloride plus impurity in the platinum crucible of the growing furnace. Distribution of impurities in samples was calculated by plotting the ratio of the concentration of manganese atoms in the solid to the initial concentration in the melt against the fraction of melt solidified. Distribution of impurities in the crystal was found to obey Pfann's equation, which was used to plot the fractional impurity concentration as a function of the distribution coefficient for a series of values. Distribution coefficients are shown for growth rates of 22.4, 20.1, and 13.2 mm/hr.

4810 APTIC NUMBER 14022

Mutriskov, A. Ya., O. V. Maminov, K. G. Ismagilov, and A. G. Usmanov
AN ENTROPY METHOD OF ANALYZING CHEMISORPTION PROCESSES. Intern. Chem. Eng., 5(1):58-61, Jan. 1965. 13 refs. (Also: Izv. Vysshikh Uchebn. Zavedenii Khim. i. Khim. Tekhnol., no.

3:486-491, 1964.)

An entropy method for studying the kinetics of chemisorption used the variation of the entropy (S1-S)* as the driving force for the process. An equation for the rate of chemisorption of CO_2 by NaOH solutions was derived. The mass transfer constant is dependent only on the temperature at which the process is carried out. Thus, the independence of the mass transfer constant on the contact surface area and the physicochemical conditions of the mass transfer process indicates that the entropy variation may be conveniently used as the driving force for the process. (Author conclusions modified)

4811 APTIC NUMBER 14056

Nesterenko, V. B. and B. Ye. Tverkovkin
REACTION EQUATIONS FOR THE REVERSIBLE SYSTEM N_2O_4 YIELDS $2NO_2$ YIELDS 2NO PLUS O_2 IN A FLOW. (Uravneniya kinetiki khimicheskikh reaktsiy sistemy N_2O_4 yields $2NO_2$ yields 2NO plus O_2 v potoke). Text in Russian. Vestsi Akad. Nauk Belarusk. SSR: Ser. Fiz. Tekhn. Navuk, no. 1:34-43, 1966. 13 refs.

A mathematical description of the reaction kinetics for the reversible system involving nitrogen tetroxide, nitrogen dioxide, nitric oxide, and oxygen in a flow is presented. A mathematical model of heat and mass transport in the presence of chemical reaction is described in general using the differential equations of mass, momentum, and energy conservation. Good agreement with experimental data from the literature is found. The proposed method may be applied to the question of heat flow in cases both with heating and with cooling, and also to more complex chemical reaction schemes. The question of heat exchange within the chemically reacting mixture is not treated.

4812 APTIC NUMBER 14167

Neumann, Bernhard and August Sonntag
DECOMPOSITION PRESSURES OF NITRATES AND SULFATES. IV. MEASUREMENTS ON SODIUM VANADATES. (Zersetzungsdrucke von Nitraten und Sulfaten. IV. Messungen an Natriumvanadaten). Text in German. Z. Elektrochem., 41(12):860-868, 1935. 11 refs.

The dissociation pressures of alkali vanadates were measured to determine whether alkaline metals have a positive effect in the use of vanadic acid catalysts. To test their possible use as catalysts, something had to first be known about oxygen dissociation. If dissociation takes place at temperatures lying within the effective range of the catalyst or higher (the case with pure vanadic acid), and if reoxidation is possible, the substance fulfills all criteria for use as a catalyst. The results show that both the meta and pyro vanadate have oxygen dissociation curves beginning far below the effective range of catalysis. It was also found that the dissociation pressures depend on the carrier substance. The presence of silicon dioxide changes only the physical properties of the catalyst, i.e., as a stabilizer, but does not influence reaction kinetics. The dissociation curve of meta vanadate suggests that pyrovanadate is formed, a compound which is able to liberate six times as much oxygen. Sulfate tension curves were obtained after sodium meta vanadate was treated with sulfurous acid and the heat of dissociation was computed from the temperature coefficient. The pressure measurements showed formation of intermediate products which were less stable than vanadyl sulfate, but their structure was uncertain.

4813 APTIC NUMBER 14115

Noda, I. and H. Ueda
RESEARCH ON THE BURNING OF LIMESTONE: THE EFFECT OF ADDING SALT TO THE BURNING. (Sekkaiseki nensho ni kansuru kenkyu (dai 2 ho) nensho ni oyobosu enrui tenka no eikyo). Text in Japanese. Kogyo Kagaku Zasshi (J. Chem. Soc. Japan), vol. 54:418-421, 1933.

The burning rate of limestone is shown to decrease by 60% when its surface is lightly coated with a salt solution and dried. After the treated limestone is injected into a furnace, the salt layer vaporizes. In its final state, the limestone is softer and its volume is increased. The order of effectiveness for the salts tested is potassium chloride, sodium chloride, lithium chloride, magnesium chloride, calcium chloride, and strontium chloride.

4814 APTIC NUMBER 14246

Otto, Harry W. and Ralph P. Seward
PHASE EQUILIBRIA IN THE POTASSIUM HYDROXIDE-SODIUM HYDROXIDE SYSTEM. J. Chem. Eng. Data, 9(4):507-508, Oct. 1964. 3 refs.

Fused solutions of sodium hydroxide and potassium hydroxide were cooled under equilibrium conditions to obtain freezing point measurements for various mixtures of the two components. Cooling temperatures were measured by a thermocouple calibrated with samples of tin, lead, and zinc, and points at which breaks were observed were interpreted as initial, freezing, eutectic, and transition temperatures. Results are not in agreement with Hevesy's phase diagram showing continuous solid solutions with a minimum in the liquidus curve. A eutectic at 170 deg and 41 wt% NaOH is clearly indicated. Transition temperature becomes substantially constant when the NaOH content of the system reaches 10%. If the possibility of solid solution formation is disregarded, a heat of fusion of 2200 cal/mole can be calculated for KOH from the freezing point lowering. Since the eutectic halt was found with only 3.7% NaOH, the extent to which NaOH can be incorporated as a solid solution in the low-temperature form of KOH must be very small. On the sodium hydroxide side of the diagram, the solubility of KOH in solid NaOH appears to be even smaller. Here the heat of fusion is calculated at 1560 cal/mole.

4815 APTIC NUMBER 14219

Oza, Trambaklal Mohanlal and Vasantrai Trambaklal Oza
THE ACTION OF DINITROGEN TETROXIDE ON HYPONITRITES, NITRITES AND OXIDES. THE INDUCED DECOMPOSITION OF HYPONITRITES. J. Am. Chem.

Soc., 78(15):3564-3567, Aug. 1956. 15 refs.

To elucidate the effect of nitrogen dioxide on oxides, nitrates, and hyponitrites, all of which are present in the thermal decomposition of hyponitrites, N2O4 and NO2 were reacted with Ag2N2O2, SrN2O2-5H2O, and SrN2O2; with AgNO2, Ca(NO2)2-H2O, and Ca(NO2)2-1/4H2O; and with Ag2O and CaO. Both solid and gaseous products of the reactions were quantitatively analyzed. Results show that (1) the nitrogen of the hyponitrite molecule does not remain intact; (2) water exercises a profound influence on the reactivity of the nitrites, hydrated nitrite reacting even at 0 deg and anhydrous silver nitrite reacting only at 120 deg; (3) nitrate is the primary product of the reaction of N2O4 or NO2 with CaO, but both nitrate and nitrite are produced by the reaction with Ag2O; and (4) formation of nitrous oxide and nitrogen from the action of dinitrogen tetroxide on hyponitrites does not take place directly from N2O4 but originates from the hyponitrites. The thermal decomposition of the hyponitrites is shown to occur in the sequence M2N2O2 yields M2O plus N2O and (2) 3M2N2O2 yields 2M2O plus 2MNO2 plus 2N2. Lack of appearance of oxide in the products and appearance of nitrate can be ascribed to secondary reactions of the oxide and nitrite formed with N2O4 and NO2.

4816 APTIC NUMBER 14324

Pascucci, Richard P. and Gary W. North
MISSION 73, SUMMARY AND DATA CATALOG. Geological Survey, Washington, D. C., for NASA, Contract R-09-020-024(A/1), Task 160-75-01-32-10, Interagency-NASA-132, 277p., Aug. 1968. 40 refs.
CFSTI: N69-28153

Land use data determined by remote sensing equipment mounted in aircraft was compared with data obtained by actual ground measurements in an attempt to develop remote sensing equipment for application of geographical data to earth resources studies. Data were acquired over Los Angeles, the Coachella Valley, and the Imperial Valley, where properties were also measured on the ground. The remote sensors included an ultraviolet scanning radiometer and ultraviolet absorption spectrometer, a television camera, a 12-in. focal length aerial camera, eight 3-in. focal length cameras, a microwave radiometer, an infrared scanning radiometer, a scatterometer, a scanning microwave radiometer, a metric camera, a medium resolution infrared scanner, and an infrared thermometer. Ground activites conducted before, during, and after the flights resulted in the acquisition of soil moisture samples, thermometric and radiometric surface temperatures, surface reflectance measurements, land use maps, hourly weather readings of SO2 and NO2, calibrated test target readings, atmospheric particle counts, soil-bearing strength measurements, and soil electrical resistivity measurements. Several tentative conclusions were reached. Infrared Aero Ektachrome film is the single most effective sensor for land use determination. The scatterometer demonstrated potential for agricultural land use discrimination. The thermal IR scanner is superior to the UV scanner and passive microwave scanner for land use determination. Ultraviolet absorption spectroscopic measurements correlate well with ground measurements of atmospheric NO2 and SO2. Urbanized areas can be located on passive microwave imagery. The passive microwave scanning radiometer can detect wind disturbance, hence horizontal energy transfer over large bodies of water. The passive microwave radiometers, because of their long integration time, are of little use in determining soil moisture concentrations. The scanning microwave radiometer shows potential for soil moisture detormination. (Author abstract modified)

4817 APTIC NUMBER 14217

Payson, Peter
ULTRA HIGH STRENGTH STEEL. (Crucible Steel Co. of America, Inc., Pittsburgh) U. S. Pat. 3,148,980. 4p., Sept. 15, 1964. 1 ref. (Appl. Oct. 24, 1960, 6 claims).

An ultra-high strength steel is described for conventional applications that can also be conventionally heated to exhibit ultra-high strength and hardness, and can thus be used for the production of certain tools in which high hardness for longer tool life must he combined with high toughness to withstand shock loads; examples of such tools are punches, forming tools, chisels, and shear blades. It also provides a low alloy steel which exhibits high tensile and yield strength, good ductility and toughness, and high hardness upon being subjected to conventional heat treatment. Applications are foreseen particularly in the aircraft industry and in the field of rocketry and missiles. Currently available steels are viewed as inadequate for the increasingly high standards of such applications. Broad, preferred, and optimal compositional ranges of the steel are given; the optimal composition described is 0.53 to 0.58% carbon, 0.10 to 0.20% manganese, 1.70 to 2.10% silicon, up to 0.20% nickel, 1.10 to 1.40% chromium, 1.20 to 0.35% vanadium, 0.40 to 0.70% molybdenum, the balance being substantially iron. This steel would be characterized by a 0.2% offset yield strength of at least 275,000 psi, a hardness of greater than Rockwell C58, and a V-notch impact strength of at least 10 ft-lbs at room temperature when subjected to conventional heating. Chemical analyses and test data are given for vacuum-melted and air-melted steels; comparison of results indicates that both tensile and yield strength values are superior in the case of vacuum-melted steels. However, although vacuum induction melting constitutes a preferred mode of making the invented steels, any melting process, including air melting, is applicable.

4818 APTIC NUMBER 14293

Peatman, W. B., T. B. Borne, and E. W. Schlag
PHOTOIONIZATION RESONANCE SPECTRA. I. NITRIC OXIDE AND BENZENE. Chem. Phys. Letters (Amsterdam), 3(7):492-497, July 1969. 21 refs.

A new method is described for the study of ionized molecules by direct observation of optical resonance in photoionization. This method interposes an electron filter in the system so that a signal is detected in the measuring circuit only at the point where the optical monochromator sweeps through a resonance transition. Photoionization is carried out at the intersection of a well-focused beam of light and a high intensity molecular beam at right angles to the photon beam. Electrons are withdrawn perpendicular to both of these beams. The energy of the photoionization resonance is directly read off the setting of the optical monochromator. Contributions from lower photoionization processes are avoided. Photoionization resonance scans of benzene show the presence of two peaks at 10.385 and 10.471 eV, respectively. It is thought that these peaks are due to a new electronic level of C6H6(plus) at 10.385 eV and that this level corresponds to the removal of a sigma electron from the benzene molecule. Data obtained for NO(plus) using this method were compared with data previously obtained by other methods. The average ionization potential of five experimental runs was in exact agreement with the spectroscopic value of other investigations.

4819 APTIC NUMBER 14242

Pitzer, Kenneth S.
SOLUBILITY AND THE NATURE OF BONDING IN FUSED ALKALI HALIDE-METAL SYSTEMS. J. Am. Chem. Soc., 84(11):2025-2028, June 19, 1962. 21 refs.

A qualitative theory was first developed to explain the ability of fused salts and liquid metals to dissolve in one another and then tested against solubility data, with certain parameters evaluated empirically. A solid or liquid mixture of an alkali metal with a halide of the same metal is considered to be a mixture of two negative species: halide ions and valence electrons of the metal. Positive ions in a liquid mixture will form an irregular lattice whose cavities contain the negative ions. Where metal concentration is high or salt is the abundant species, valence electron of a liquid mixture are no longer localized in particular cavities corresponding to the size of the halide ions. Instead they are contained in isolated cavities similar to the F-centers of solid state mixtures. Formation of a fused salt-metal solution is thought to comprise (1) the conversion of the metal to the ionic lattice of positive ions and F-centers and (2) the mixing with the metal halide. Since energy changes in the second step are small, the energy of mixing is related to the excess energy of the ionic lattice metal. The entropy of random mixing and reduced vibration frequencies of the ions near the F-centers contribute to substantial positive excess entropies of mixing. Solubility studies with a sodium hydroxide model were consistent with data indicating that continuous transition from metal to nonmetallic character occurs only above a critical mixing temperature.

4820 APTIC NUMBER 14282

Prausnitz, J. M. and F. H. Shair
A THERMODYNAMIC CORRELATION OF GAS SOLUBILITIES. A.I.Ch.E. (Am. Inst. Chem. Engrs.) J., 7(4):682-687, Dec. 1961. 43 refs.

Low-pressure solubility data were correlated for eleven gases in nine solvents over a wide temperature range by considering the dissolution process in two steps. First, the gas is condensed isothermally to a hypothetical liquid at 1 atm pressure, and then this hypothetical liquid is dissolved in the solvent. The free energy of the first step depends only on the properties of the solute, which in the case of nonpolar gases can be adequately described by the theorem of corresponding states. The second step depends on the properties of both solute and solvent and, in the case of nonpolar systems, can be described by the theory of regular solutions. The correlation depends on three solute parameters: the solubility parameter, the molar volume, and the fugacity of the hypothetical liquid; the last of these was plotted as a generalized function for the reduced temperature range of 0.7 to 3.2. A separate plot was made for hydrogen. These parameters may be used to make good estimates of low-pressure gas solubilities in nonpolar solvents over a wide range of temperature. A semiempirical method for correlating the solubilities of gases in polar solvents is also described and illustrated for several cases. Since the correlation presented in this paper covers a wide temperature range, it is possible to make estimates of the heats of solution of gases in liquids. These may be useful in enthalpy-balance calculations as required in certain phase-separation operations. (Author abstract modified)

4821 APTIC NUMBER 14106

Ramirez-Munoz, J., M. Roth, and Maila Ostring
HYDROCHLORIC ACID SYSTEMS IN ATOMIC ABSORPTION FLAME PHOTOMETRY. Flame Notes, Beckman, 1(4):93-101, 1966. 6 refs.

Sensitivity and linearity of Na, K, Ca, Mg, Fe, Mn, and Zn were investigated as functions of element concentration, absorption profile, and acidity as applied to the preparation of acidic sample solutions for atomic absorption determination of these elements in samples such as cements, fertilizers, and clays. Analytical results were compared using aqueous and 0.5 N HCl standards. Instruments used were a Beckman Model 979 Atomic Absorption Spectrophotometer with a Beckman 10 in. Potentiometric Recorder and Laminar Flow Burner. In the special case of calcium, type of flame and the use of lanthanum as a releaser were also investigated. Results show that preliminary removal of acid before final dilution is not necessary as long as sample and standard solutions have the same acid content. The influence of the change from aqueous to acid solutions on both percentual and fluctuational sensitivity is demonstrated by experimental results given in two tables. The percentual sensitivity of Na, Ca, and Mn did not change appreciably, while slight changes were observed for other elements. In general, better fluctuational sensitivity was achieved with water solutions, except for Mg and Fe. The presence of acid tended to increase noise with the other elements. Highest sensitivity was usually found at heights between 0.2 in. and 0.5 in. over the top of the burner. Height of the burner was found to be critical for each element and should be rechecked when switching from aqueous to acid solutions. The method is deemed applicable to analyses in which these elements have to be determined in the presence of HCl up to concentrations equal to those tested (0.5 N HCl).

4822 APTIC NUMBER 14259

Regner, A. and A. Simecek
KINETICS AND MECHANISM OF SULPHUR DIOXIDE OXIDATION ON A

VANADIUM CATALYST. III. CORRELATION OF THE DATA WITH EQUATIONS DERIVED FOR THE REDUCTION-OXIDATION MECHANISM. Collection Czech. Chem. Commun. (Prague), 33(8):2540-2547, 1968. 7 refs.

Oxidation rates of sulfur dioxide on a vanadium catalyst, measured in a differential reactor with gas recirculation, were correlated with kinetic equations derived for different variants of the reduction-oxidation mechanism. Based on the results of this study, a mechanism of the reaction in question is proposed. (Author abstract modified)

4823 APTIC NUMBER 14235

Reisfeld, Renata and Alexander Honigbaum
DIFFUSION OF BISMUTH IONS IN POTASSIUM CHLORIDE CRYSTALS. J. Chem. Phys., 48(12):5565-5569, June 15, 1968. 18 refs.

The diffusion of bismuth in single crystals of potassium chloride was measured with a spectrophotometer at 275 to 674 C and at a constant BiCl3 vapor pressure. The absorption band of crystals heated to 400 C peaked at 3200 A, while crystals heated at higher temperatures showed a gradual shift to 3350 A at the highest temperature, 674 C. Diffusion in the high-temperature region is assumed to be that of divalent bismuth and to be government by the usual vacancy mechanism. In the low-temperature region, the trivalent bismuth originally present diffuses by an interstitial mechanism. Diffusion coefficients show that diffusion is independent of concentration from 275 to 400 C but dependent on concentration above 497 C. Activation energies of high-temperature diffusion of divalent bismuth and low-temperature diffusion of trivalent bismuth are 0.97 eV and 0.63 Ev, respectively. The energy of formation of the diffusing complex Bi(2 plus) and vacancy is 0.57 eV. It is concluded that interstitial diffusion is determined by the jump of the vacancies around the bismuth. This mechanism can be applied to other polyvalent impurities with jump energies lower than that of self-diffusion and radii smaller than host cations.

4824 APTIC NUMBER 13996

Remy, H. and W. Hene
ADSORPTION MEASUREMENTS WITH STREAMING GASES. (Adsorptionsmessungen mit stroemenden Gasen). Text in German. Kolloid-Z. (Germany), 62(2):154-157, 1933. 5 refs.

For comparison of previously described adsorption tests with charcoal using quiescent gases (static method), adsorption tests with the same charcoal were made with flowing gases (dynamic method). The latter method yielded values which were significantly different from the static values. Also, the ratio of adsorptabilities of the gases investigated (SO2 and CO2) was found to be not fully independent of the methods employed. However, the differences can be readily explained as due to a different state of the charcoal brought about by the test conditions. It would be possible to infer from adsorption measurements made with quiescent gases the adsorptability of flowing gases if the dependence of the adsorptivity of charcoal on its state, especially on its moisture content, were taken into account. In so doing, it should be remembered that a given moisture content of the charcoal affects the adsorption of different gases to a different extent.

4825 APTIC NUMBER 14232

Rice, O. K.
A KINETIC APPROACH TO THE THERMODYNAMICS OF IRREVERSIBLE PROCESSES. J. Phys. Chem., 61(5):622-629, May 1957. 20 refs.

The study of flows of heat and matter which occur under gradients of temperature and concentration is considered in terms of a transfer process involving the exchange of molecules from both solvent and solute, with transfer of solute in one direction accompanied by transfer of solvent in the other. This process takes place within the transfer unite whose interaction with the rest of the solution is 'average' and does not change when the transfer occurs. A transfer unit which is the same as the original unit except that the reverse process can occur in the inverse unit. Differences between the concentrations of direct and indirect units result from the tendency of a transfer unit to come into equilibrium with a specific component of the solution at the point in the gradient where this component actually occurs in the transfer unit. From the hypothesis that transfer units have definite temperatures and concentration gradients, equations were determined for calculating fluxes and heat of matter. The kinetic formulation is shown to support reciprocal relations between phenomenological coefficients and to give automatically the laws of irreversible thermodynamics. Equations are also derived for the Soret effect and for systems with charged particles; they are discussed from the point of view of heats of transfer of OH(minus) and H(plus). The extension of the transfer unit theory to heterogeneous systems, where the temperature gradient occurs in the membrane, is considered and illustrated by application to the Knudsen flow of gas through a porous plug.

4826 APTIC NUMBER 14099

Roe, D. K.
ELECTROCHEMICAL FRACTIONATION: POTENTIOSTATIC CHROMATOGRAPHY AND ELUTION VOLTAMMETRY. Anal. Chem., 36(12):2371-2372, Nov. 1964. 8 refs.

Recent developments in column electrolysis are reviewed and additional techniques are suggested. Improved electrochemical separations through multiple extractions or countercurrent fractionation do not appear to be necessary. However, by analogy with column chromatographic techniques and considering the ease with which the partition ratios can be changed, a new dimension of versatility of operation can be visualized in many electroanalytical methods through the use of column electrodes and flowing solutions. The major difficulty in the design and preparation of the electrolytic column is the electrode which functions as the stationary phase. A cell which meets the requirements was designed and it appeared that the major obstacle was the electrode material. The stationary phase consisted of amalgamated nickel particles. Because of the low solubility of nickel in mercury, this electrode behaved very much like amalgamated platinum. It was found that elution voltammetry effectively increased the signal to noise ratio compared to coulometry and amperometry. Since flowing electrolyte solutions of high purity are required for elution, they can be pre-electrolyzed in a separate column. This method of pre-electrolysis could be of general use in the purification of electrolyte solutions. When the separation factor is so small that adequate separation is not obtained in elution voltammetry, fractionation can be used. A further possibility is fractionation through adsorption on electrode surfaces, since this is potential-dependent.

4827 APTIC NUMBER 14187

Poesner, Gerhard
SULFUR RECOVERY FROM WASTE GASES. PHYSICAL-CHEMICAL FOUNDATION OF SULFUR DIOXIDE REDUCTION AND TECHNICAL REALIZATION OF THE PROCESS. (Schwefelgewinnung aus Abgasen. Physikalish-chemische Grundlagen der Schwefeldioxydreduktion und technische Gestaltung des Verfahrens). Text in German. Chem. Fabrik, 10(9/10):101-106, March 3, 1937. 36 refs.

In a search for a method to obtain sulfur from SO2 containing gases, the reduction of sulfur dioxide was experimentally investigated. It was found that outright conversion of sulfur dioxide by coke according to equation SO2 plus C yields CO2 plus 1/2S2 is not feasible because COS and CO are formed in side reactions. These gaseous compounds can be converted to sulfur vapor and carbon dioxide by reaction of sulfur dioxide with a catalyst at temperatures between 400 and 750 C. Thus, sulfur dioxide can be reduced to elementary sulfur in two stages. An elementary sulfur production process for utilization of weakly acidic SO2-laden gases was developed. In this process, the gases are not directly reduced; they are first subjected to an absorption process with organic bases and water to obtain 100% sulfur dioxide. Subsequently, the sulfur dioxide is reduced in a coke generator. A catalyst liberates it from the by-products COS and CO. Condensation to liquid sulfur is achieved through cooling with water and through electrostatic precipitation. In this way, coke consumption remains limited to the conversion of sulfur dioxide, a great advantage over the direct process, where coke is needed for binding of the free oxygen. By intermediate acidification of the weakly acidic roasting gases, concentration fluctuations have no effect on the reduction process. The sulfur obtained is almost 100% pure. It is free of arsenic, selenium, and bitumen.

4828 APTIC NUMBER 14185

Roth, A. and H. Zeumer
STUDY ON THE THERMOCHEMISTRY OF SULFUR DIOXIDE. (Beitraege zur Thermochemie des Schwefeldioxydes). Text in German. Z. Elektrochem., 38(3):164-170, 1932. 15 refs.

By excluding oxidation, the evaporation heat of liquid sulfur dioxide was newly determined at 21 C. For this purpose, SO2 was condensed in a bath of solid carbon dioxide and petroleum, the feed duct was melted away, and in its place, a magnetically destructable valve with an absorption vessel containing KI solution was attached. Two measurement series were conducted. In the second series, considered the more important one, the negative evaporation heat was somewhat overcompensated by strictly measured electric energy supply and was found to be -5.68 plus or minus 0.01 kcal. To measure the solution heat, a liquid-filled glass ball with a capillary was placed into a V2A steel container and crushed. Since sulfurous acid solutions attacked the stainless steel, a thin vaseline layer had to be applied. The steel container hung on a tripod in a petroleum-filled calorimeter. Heat of solution values are larger than those obtained earlier from the temperature variation of the solubility. The neutralization heat has never before been measured. Gaseous sulfur dioxide was neutralized with 2 KOH at 20 C. The solution was heated to the boiling point and then cooled in nitrogen atmosphere. The curve which was obtained showed a weak minimum which cannot be fully explained. The dissociation heats of the first and second stage of H2SO3 are positive; the first is plus 4.34, the second larger than plus 2.3 kcal. The solution heat of SO2 with dissociation resembles that of carbon dioxide.

4829 APTIC NUMBER 14188

Roth, W. A., F. Grau, and A. Meichsner
CONTRIBUTIONS TO THE THERMOCHEMISTRY OF SULFUR. III. (Beitraege zur Thermochemie des Schwefels. III.) Text in German. Z. Anorg. Allgem. Chem., vol. 193:161-175, 1930. 13 refs.

Gaseous SO2 was oxidized with dilute hydrogen peroxide solutions in a calorimeter at 20 C to dilute sulfuric acid. The heat developing upon decomposition and dilution of H2O2 was measured at various concentrations. The results showed good agreement with values obtained in recent American studies. The heats developing upon dilution were remarkably small. For the heat developing upon oxidation of SO2, a value higher than that obtained by Thomsen was found. By using the enthalpies of SO2, the enthalpies of liquid SO3, H2SO4, and 5000 parts H2O were computed. Comparison with older thermochemical data led to the conclusion that the values for the heat of dilution are too high. From solubility data, new lower values were derived which show the high increase with increasing dilution demanded by the theoretical finding. Efforts to burn sulfur in a steel container to a mixture of SO2 and SO3 and to derive the enthalpies of both oxides failed because the SO2 became oxidized. If side reactions are avoided, many heats of oxidation can be determined with dilute H2O2 solution. If sulfur dioxide heat of solution is accurately determined, reduction heats of SO2 solutions in inert atmospheres can be measured.

4830 APTIC NUMBER 14186

Roth, W. A. and Hans Zeumer
FINAL NOTE. ON THE THERMOCHEMISTRY OF SULFUR DIOXIDE. (Schlussbemerkung. Zur Thermochemie des Schwefeldioxydes). Text in German. Z. Elektrochem., 38(4):248, 1932.

To explain the striking characteristic of the neutralization heat of SO2 plus 2KOH, the heats developing from the dilution of KOH were determined. Dilutions proceeded in the following manner: (1) (SO2) plus 2KOH.67H2O yields K2SO3.34H2O plus 2H2O plus 38.37 kcal; (2) (SO2) plus 2KOH.2100H2O yields K2SO3.4200H2O plus 2H2O plus 40.85 kcal; (3) 2KOH.67H2O plus aq yields 2KOH.2100H2O plus 0.76 kcal; and (4) K2SO3.134H2O plus aq yields K2SO3.4200H2O plus 2.79 kcal. The striking variation of the neutralization heats with concentration can be explained by the highly different dilution heats of KOH, and K2SO3.

4831 APTIC NUMBER 14281

Ruthven, D. M. and C. N. Kenney
EQUILIBRIUM CHLORINE PRESSURES OVER CUPRIC CHLORIDE MELTS.
J. Inorg. Nucl. Chem., 30(4):931-944, 1968. 32 refs.

Equilibrium chlorine vapor pressure measurements are given for the liquid systems CuCl2-CuCl, CuCl2-CuCl-KCl, CuCl2-CuCl-KCl-LaCl3, and CuCl2-CuCl-ZnCl2 and are discussed in relation to phase diagrams and other published thermodynamic data. The measurements, which were made as part of a study of the Deacon reaction over molten halide salts, indicate that the liquid systems CuCl2-CuCl and CuCl2-CuCl-ZnCl2 behave as approximately ideal solutions. The systems involving potassium chloride are more complex, as nonideal entropies of mixing are involved. The addition of potassium chloride to the binary liquid system CuCl2-CuCl leads to a negative excess entropy for the reaction CuCl2 yields CuCl plus 1/2Cl2, and since there is little evidence of a nonideal entropy effect due to potassium-cuprous interaction, it is inferred that the partial molar entropy of cupric chloride in the ternary system CuCl2-CuCl-KCL is greater than in the binary system CuCl2-CuCl. The behavior of the systems containing lithium or sodium in the place of potassium are broadly similar, although the magnitude of the effects are smaller. Addition of lanthanum chloride has no significant effect on equilibrium chlorine pressure, nor does the presence of zinc chloride cause marked deviations in enthalpy and entropy values.

4832 APTIC NUMBER 13975

Scheve, J. and E. Scheve
SEMICONDUCTION AND CATALYSIS. IV. QUANTUM ASPECTS OF CATALYSIS, ELUCIDATED THROUGH INVESTIGATIONS ON MIXED OXIDE CATALYSTS. (Halbleitung und Katalyse. IV. Quantenaspekte der Katalyse, erlaeutert durch Untersuchungen an Mischoxidkatalysatoren). Text in German. Z. Anorg. Allgem. Chem., vol. 333:143-153, 1964. 16 refs.

The dependence of the catalytic activity of semiconducting mixed oxide catalysts on the thermal activation energy of the charge carriers was checked by means of new experiments and is now interpreted assuming quantum-chemical resonance effects. On this basis, a high catalytic activity appeared to result if the total energy of the charge carriers of the catalyst corresponded with the promotion energy of one of the interacting molecules. This was deduced from new catalytic investigations on 3- and 4-component catalyst systems of the oxides of Mn, Co, Cu and Ag using the CO oxidation as test reaction, and on the systems Cr2O3/SnO2, Cr2O3/TiO2 and Cr2O3/Al2O3 catalyzing the SO2 and H2 oxidation, respectively. (Author summary modified)

4833 APTIC NUMBER 14215

Shams El Din, A. M.
MOLTEN SALT ELECTROLYSIS. I. CHLORINE OVERPOTENTIAL ON CARBON IN LICL-KCL EUTECTIC. Electrochim. Acta, 4(2-4):242-250, 1961. 24 refs.

A dry LiCl-KCl eutectic salt suitable for the measurement of chlorine overpotential on carbon anodes was prepared to determine whether the overpotential is an activation or a resistance polarization. The results showed that the chlorine evolution on carbon anodes from LiCl-KCl melts at temperatures from 425 to 650 C and with currents from 10 to 2000 mA/electrode is entirely resistance-controlled. Both the melt and the gas film on the surface of the electrode contributed to the total measured resistance, but the major part of the measured resistance was assigned to the gas film. This resistance is the determining factor in the evolution of chlorine on graphite anodes in molten LiCl-KCl eutectic melts. The complete absence of activation polarization was not surprising. Electrode reactions in molten salts are seldom activation-controlled due to the high temperatures involved. The addition of an indifferent salt, K2SO4, to the eutectic, resulted in the establishment of concentration polarization and an increase in the resistance. In the concentration range studied, the evolution of chlorine followed only one polarization stage, thus differing from that of aqueous solutions. It was concluded that the theory advanced to explain chlorine evolution in aqueous solutions does not apply to chlorine evolution in molten LiCl-KCl eutectic melts.

4834 APTIC NUMBER 14243

Shams El Din, A. M.
ON POTENTIOMETRIC ACID-BASE TITRATIONS IN MOLTEN SALTS: THE SYSTEM K2CR2O7-K2CRO4-KOH. Electrochim. Acta, vol. 7:285-292, 1962. 13 refs.

Potentiometric titration of K2Cr2O7 and CrO3 acids with KOH was carried out in molten KNO3 at 370 deg and above. An oxygen electrode was used as an indicator electrode, while an Ag/Ag(plus),KNO3 electrode served as a suitable reference electrode. Titration of K2Cr2O7 followed typical potentiometric curves, exhibiting a distinct potential drop of about 700 mV at the point where the acid's dark red-orange color changed to the yellow-red of the chromate. At 370 deg, the quantities of KOH consumed in neutralizing the dichromate were proportional to its content in the melt but 14.8 to 15.8% greater than those calculated theoretically. At 480 deg, the titration curves indicated the absence of linearity. Above 400 deg, the dichromate attacked the nitrate substrate. Though the potentials measured in CrO3 melts corresponded to those of the K2Cr2O7 melts, titration curves exhibited only one neutralization step which did not correspond to the overall reaction CrO3 plus

O(2 minus) yields CrO_4(2 minus). Chromic acid presumably reacts with the nitrate base to yield $K_2Cr_2O_7$ according to the reaction $2CrO_3$ plus $2KNO_3$ yields $K_2Cr_2O_7$ plus N_2O_5. Quantities of KOH consumed in neutralization were proportional to the original CrO_3 content in the melt. Titration of molten KOH with $K_2Cr_2O_7$ produced two neutralization steps. Quantities of dichromate consumed up to the second inflection point on the titration curve were proportional to those of KOH in the melt.

4835 APTIC NUMBER 14069

Shandorov, G. S.
EFFLUX FROM A CHANNEL INTO STATIONARY AND MOVING MEDIA. (Istecheniye iz kanala v nepodvizhnuyu i dvizhushchuyusya sredu). Text in Russian. Zh. Tekhn. Fiz., 27(1):156-179, 1957. 6 refs.

Correction of the Mises solution for plant efflux into a stationary medium is presented, together with results from an experimental study of air discharge from a channel. It is theoretically established that efflux of an ideal incompressible fluid through an orifice in the wall of a channel into a stationary medium of the same density is determined by two parameters: Euler number (ratio of excess pressure to velocity head, in unperturbed flow) and relative orifice size. Calculated dependences of efflux coefficient on these parameters are in satisfactory agreement with experimental data. An additional determining parameter in the experimental case is the Euler number defined as the ratio of excess pressure in the channel to the velocity head in the unperturbed departing flow. The efflux coefficient was found to be the same function of this second Euler number for both isothermic and nonisothermic efflux. When two or three circular orifices placed in line along the flow are moved closer together (distance between them equal to 1-3 times orifice diameter) the efflux coefficient increases from a value close to that for a single orifice, to that of an elliptical orifice of corresponding length. The efflux coefficient for slot orifices is more suitably related to the sum of excess pressure and the fraction of velocity head in the channel, taking to account the coefficient of velocity head, which depends considerably on the slot height.

4836 APTIC NUMBER 14258

Sherman, Albert and Henry Eyring
QUANTUM MECHANICS OF ACTIVATED ADSORPTION. J. Am. Chem. Soc., 54(6):2661-2675, July 1932. 12 refs.

When binding energies are expressed as 10% of the total for all atom pairs, the quantum mechanical calculations of the activation energies for the hydrogenation of ethylene, acetylene, and the activated adsorption of hydrogen on charcoal at zero K are, respectively, 51.5, 24.4 and 8.8 kg cal. Better agreement with the values obtained by Pease occurs when the coulombic energy is taken as 14% of the total binding. The mechanism for the conversion of ortho-to para-hydrogen on charcoal involves three steps: activated adsorption, collision and reaction of two adjacently adsorbed hydrogen molecules, and desorption. At very low temperatures, the last step, a zero-order evaporation process, is undoubtedly the rate-determining step. As the temperature increases, the rate of desorption increases until finally the collision of two adjacently adsorbed molecules is the slow process. With increasing temperature, the chance of two hydrogen molecules being adsorbed in adjacent positions approaches zero, and simultaneously the conversion of para- to ortho-hydrogen drops to zero. Since the adsorption obtained is the so-called atomic adsorption, the C-H bonds must have strength of 51.8 kg cal in order that the final bonds will have strength of only 2 kg cal more than the initial hydrogen bond. A carbon dioxide distance of 3.6 A is most favorable for calculating the energy of the bonds at 51.8 kg cal. The mechanism of conversion is assumed to involve the collision of a hydrogen molecule from the gas phase with an adsorbed hydrogen molecule. The problem of spin degeneracy of six electrons is solved, and an equation for the potential binding energy of the six electrons is applied to the calculation of activation energies.

4837 APTIC NUMBER 14245

Shozda, R. J.
COMPLEXES OF SULFUR DIOXIDE WITH IONIC AZIDES. Inorg. Chem., 6(10):1919-1921, Oct. 1967. 9 refs.

Sulfur dioxide is reversibly absorbed by alkali metal azides at room temperature, the ease of absorption increasing with the atomic number of the cation. An infrared spectrometric characterization of the complexes formed by reactions between SO_2 and sodium, ammonium, tetramethylammonium, or dibenzyldimethylammonium azides shows that their chemical properties are the same as those of the parent azides. This suggests that the complexes are bound by weak rather than by strong bonds. In some cases, however, the complex is directly involved in the reaction. Triphenylphosphine, for example, causes the slow liberation of nitrogen from a mixture of sodium azide and sulfur dioxide. In another example of complex participation, the addition of phosgene to a mixture of sodium azide and sulfur dioxide leads to the formation of small amounts of carbonyl azide and sulfuryl azide chloride. Sulfur dioxide-ionic azide complexes are useful for preparing organic azides. Chemical or physical activation of the azide salt is unnecessary and, in many cases, the reactions are rapid, clean, and efficient.

4838 APTIC NUMBER 14003

Spencer, K. A.
PYRITE RECOVERY FROM COAL MINE REFUSE. Coal Mine Modernization Yearbook, p. 97-104, 1940.

A process is described for recovering 25% coal and 15% pyrite from handpicked mine refuse. After being reduced to 3 in. in a single-roll coal crusher, the feed is passed over a scalping screen, fed to a jaw crusher, and then conveyed to breaker rolls where it is reduced to approximately 1-1/4 in. From here, the coal is elevated to a second vibrator screen before being carried by automatic jigs to a coal dewatering elevator where it is sluiced to coal drag. The marketable solid screenings produced contain 9 to 11% ash. Pyrite is treated in a secondary crushing circuit containing pyrite jigs and sand concentrating tables. Of the total pyrite produced, approximately 90% is recovered from the jigs and 10% from the tables. The product contains 45.38% total sulfur and 40.90% iron. Although the cost of shipping pyrite is high and the market limited, pyrite recovery is considered practical where a high concentration of high-sulfur coal mine refuse presents a difficult disposal problem. If a mining company has a consistent supply of refuse, an assured outlet for the coal, pyrite, and resultant iron cinder, recovery can be a profitable enterprise if amortized over 10 years or more. In an appended discussion by H. N. Case, the use of centrifugal driers is recommended to remove extraneous moisture and ash from coal.

4839 APTIC NUMBER 14184

Stief, Eberhard
TECHNOLOGICAL DUST STUDIES ON ENCASED CONVEYOR BELTS. (Staubtechnische Untersuchungen an Gurtfoerdererverkleidungen). Text in German. Giessereitechnik, 14(4):103-112, April 1968. 3 refs.

The efficiency of exhaust fans installed at the discharging end of encased conveyor belts was studied in 10 foundries. The actual air quantity to be drawn off by the exhaust fans, the efficiency of rapid suction, the dust concentrations at the loading and discharge ends, and the grain size distribution and chemical composition of the dust were determined. In addition, regulation of the exhaust air quantity and speed by baffles was studied to ascertain optimum conditions. Finally, the air quantities to be suctioned off at the discharge end of the belt were computed and compared to the quantities customarily used. The results showed that the installed dust collectors and exhaust systems did not fulfill sanitation requirements and that the efficiency of the ventilators was unsatisfactory. Comparison of computed and actual values shows that insufficient air quantities and duct velocities are used in practice. In many cases, no exhaust fan was installed at all. If the material on the conveyor belt is discharged into a pit more than 1 m below the exhaust fan, dust collectors must be used. Through isokinetic sampling and sedimentation analysis, the grain size distribution was determined. Considerable amounts of fine particles were found in the dust, as well as high Al2O3, SO3, and SiO2 concentrations. Dust content in the uncleaned conveyor belt air flow ranged from 1.23 to 6.31 g/cu m.

4840 APTIC NUMBER 14024

Stubbs, Clifford Morgan
THE ACTION OF SULPHUR DIOXIDE ON COPPER AT HIGH TEMPERATURES. J. Chem. Soc. vol. 103, p. 1445-1461, 1913. 10 refs.

The solubility of SO2 in molten copper was investigated by bubbling the gas through the metal and measuring the resulting depression in freezing point. The original work was extended to include an investigation of the equilibrium between SO2 and solid Cu, solid cuprous sulfide, and solid cuprous oxide. The depression of the freezing point of Cu by dissolved SO2 was found to be about 2.54 times that expected if the molecules of the gas existed unchanged in the solution. This was shown to be explainable by a partial reaction of the SO2 with the Cu. Complete reaction would give three times the amount of depression calculated from the formula SO2, and the amount of gas dissolved should vary as the cube root of pressure. Previous studies have shown that the concentration varies as the square root of pressure. Such a partial reaction would give a depression of 2.4 times that calculated for the formula SO2. This is essentially in agreement with the experimental results. Supplementary experiments on the influence of excess cuprous sulfide or oxide on the depression caused by SO2 supported the partial reaction theory. The equilibrium pressures of SO2 in the univariant system Cu, cuprous oxide, cuprous sulfide (all solid), and SO2 were measured between 700 and 1050 deg. The pressure rose from less than one to seven atm. The high value at 1050 deg explains the 'insolubility' of SO2 in solid Cu at high temperatures and ordinary pressures noted by other workers.

4841 APTIC NUMBER 14158

Swinnerton, J. W., V. J. Linnenbom, and C. H. Cheek
DISTRIBUTION OF METHANE AND CARBON MONOXIDE BETWEEN THE ATMOSPHERE AND NATURAL WATERS. Environ. Sci. Technol., 3(9):836-838, Sept. 1969. 13 refs.

Methane and carbon monoxide concentrations in the atmosphere and in natural waters were measured from samples collected during an oceanorgaphic cruise between Washington, D. C. and Puerto Rico in June 1968. The purpose of the measurements was to determine to the level of these concentrations and to obtain information on the direction of net transport across the air-water interface. Such information is expected to prove helpful in determining whether these gases are being generated in the water by biological processes and escaping into the atmosphere, or whether as the result of relatively high atmospheric partial pressures, the gases are going into solution in the seawater. The concentration of methane was highest in the upper Potomac River and decreased as the ocean was approached because of pollution in the river and bay waters. Methane was at equilibrium between the atmosphere and the open ocean where its average concentration in the atmosphere was 1.24 plus or minus 0.03 ppm. It is still not clear whether the ocean is acting as a source or a sink for methane under equilibrium conditions. Conversely, carbon monoxide concentrations increased in the open ocean relative to the river and bay waters. Equilibrium was not observed for carbon monoxide and the net transport of this gas appears to be from the water into the atmosphere for all samples analyzed. Atmospheric carbon monoxide concentrations ranged from 0.075 to 0.44 ppm. Possible natural sources of carbon monoxide in the open ocean are the photochemical decomposition of organic matter near the surface and its production by various algae, green plants, and some species of siphonophores. (Author abstract modified)

4842 APTIC NUMBER 14058

Taylor, Guy B. and Sam Lenher

KINETICS OF THE REACTION 2SO2 PLUS O2 YIELDS 2SO3 ON PLATINUM. Z. Physik. Chem. (Boden.-Fest.), p. 30-43, 1931. 16 refs.

The equilibrium reaction 2SO2 plus O2 yields 2SO3 on a platinum surface was investigated by the hot-wire method at temperatures (525, 665, and 700 deg) where rates of both forward and reverse reactions could be studied. Attempts to deduce a single mathematical expression fitting the observed data from both sides of the equation failed, but satisfactory formulas were obtained for each reaction separately. The rate of oxidation of sulfur dioxide on platinum varies directly with the distance to equilibrium and inversely as the square root of the sulfur trioxide concentration. The rate of dissociation of sulfur trioxide on platinum varies directly with the distance to equilibrium. The apparent heat of activation of SO3 formation is 16,000 cal. The apparent heat of activation of SO3 dissociation is 40,000 cal. (Author conclusions modified)

4843 APTIC NUMBER 14008

Thalmayer, C. F., S. Bruckenstein, and D. M. Gruen
CHRONOPOTENTIOMETRIC DETERMINATION OF INTERDIFFUSION COEFFICIENTS AND HEATS OF INTERDIFFUSION IN MOLTEN SALTS. J. Inorg. Nucl. Chem., 26(2):347-357, Feb. 1964. 19 refs.

The interdiffusion coefficients of Ag(I), Cd(II), Pb(II), Bi(III), and U(IV) in lithium chloride-potassium chloride eutectic and of Ag(I) in molten sodium nitrate and molten cesium nitrate were determined by chronopotentiometry and calculated from the Sand equation. The heat of activation for interdiffusion of each ion was determined by the method of least squares. The following diffusion coefficients in sq cm/sec x 1,000,000 at 400 C and heats of activation in kcal/mole were obtained for the ionic species in the LiCl-KCl melt: Ag(I), 24 and 5.8; Cd(II), 12.1 and 6.5; Pb(II), 8.9 and 7.9; Bi(III), 6.3 and 9.8; U(IV), 4.9 and 7.7. The temperature range studied was approximately 365 to 750 C. The diffusion coefficient and heat of activation for diffusion for Ag(I) in sodium nitrate are 32.5 and 4.52, respectively. In cesium nitrate they are 24.8 and 5.06. These data indicate that interdiffusion proceeds by a mechanism quite different than that for viscous flow. Since each solute ion interacts with the melt to an unknown extent, e.g., by complex ion formation with unknown coordination number, the different diffusion coefficients and activation energy values are explained by the 'effective radius' of the solute ion in the melt. Significant transport via a paired vacancy mechanisum is not supported for interdiffusion in these melts. (Author abstract modified)

4844 APTIC NUMBER 14039

Thalmayer, C. F., S. Bruckenstein, and D. M. Gruen
CHRONOPOTENTIOMETRIC DETERMINATION OF INTERDIFFUSION COEFFICIENTS AND HEATS OF INTERDIFFUSION IN MOLTEN SALTS. J. Inorg. Nucl. Chem., vol. 26:347-357, 1964. 19 refs.

The interdiffusion coefficients of various ions in several molten salts were determined over a sufficiently large temperature range to calculate the heats of activation for interdiffusion. The chronopotentiometric method was used and the interdiffusion coefficients and heats of activation were calculated for Ag(I), Cd(II), Pb(II), Bi(III), and U(IV) in LiCl-KCl eutectic solution and for Ag(I) in molten NaNO3 and in molten CsNO3. The temperature range was approximately 365-750 C. The standard deviations within each run were quite small, but the differences between runs of the same system were quite large. This seemed to indicate that the largest experimental error is in a quantity which is constant within each run, probably the analytical concentration. The other principal source of error is the measurement of the transition time. This was difficult to eliminate because prior reduction of the ion enhances the transition times for all trace impurities which were subsequently reduced. The chronopotentiometric results indicated that interdiffusion does not obey the Stokes-Einstein relation in LiCl-KCl eutectic solution, molten NaNO3, or molten CsNO3. In addition, while there was strong evidence that paired-vacancy diffusion was a significant transport process in the self-diffusion of the solvent cation and anion in some alkali metal halides and NaNO3, such as mechanism for interdiffusion seemed unlikely in the solvents studied.

4845 APTIC NUMBER 14101

Thelen, J., W. Trommsdorff, and H. Wiegand
EXPERIMENTS ON GENERATION OF UNIFORM-SIZED LIQUID DROPLETS. (Experimente zur Erzeugung von Fluessigkeitstropfen gleicher Groesse). Text in German. Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Munich, Germany, DLR-FB-67-91, 59p., Dec. 1967. 20 refs.

A literature review of theories of formation and experimental methods for generation of trains of equidistant uniform-sized liquid droplets by periodic longitudinal acceleration of thin liquid jets is followed by a detailed description of the author's apparatus and experimental procedure used to this end. Three liquids of different viscosities were employed in forming jets of 0.1, 0.2, 0.3, and 0.35 mm in diameter whose mean exit velocity into ambient air or into a low-pressure chamber could be varied between 4 and 50 m/sec. The respective jet orifices were driven by a magnetostrictive oscillator excited electrically at sonic frequencies from 5 kilohertz on up, at near its resonant (ultrasonic) frequency of about 21 kilohertz. The resulting deformation and disintegration of jets was recorded photographically using several high-speed techniques. The mean diameter of droplets obtained under various experimental conditions ranged between 0.2 and 0.6 mm.

4846 APTIC NUMBER 14083

Thomas, C. and J. Braunstein
ASSOCIATION OF SILVER(I) AND CHLORIDE IN MOLTEN CESIUM NITRATE AND IN MOLTEN MIXTURES OF POTASSIUM NITRATE WITH CESIUM NITRATE OR LITHIUM NITRATE. J. Phys. Chem., 68(4):957-959, April 1964. 13 refs.

Association constants are discussed for Ag(I) and Cl(-) measured in molten CsNO3, in molten 67:33 mole % KNO3-CsNO3 and in molten 67:33 mole % KNO3-LiNO3. Cesium nitrate was prepared by treating cesium carbonate with a slight excess of nitric acid, recrystallizing it twice from water, and drying it at 140 C. Electromotive force measurements were made both in the presence and absence of KCl. In the absence of the chloride, the e.m.f. of the cell followed the Nernst equation in the concentration of AgNO3. The change in e.m.f. upon addition of KCl was a function of the mole ratios of AgNO3 and KCl. The association constants indicated that AgCL is more stable in CsNO3 than in KNO3. This is in the direction predicted by the reciprocal coulomb effect, but the observed stabilization is smaller than the value calculated for exchange of nearest neighbor ions. Although the direction and approximate magnitude of the solvent effect in NaNO3, KNO3, and CsNO3 can be correlated with the ionic radii, the results with LiNO3 indicated the possibility of a smaller 'effective radius' of the nitrate ion in LiNO3 than in the other alkali nitrates.

4847 APTIC NUMBER 14000

Thomas, W. J. and Usman Ullah
CHEMISORPTION OF SULFUR ON METAL OXIDE CATALYSTS. J. Catalysis, 9(3):278-288, 1967.

A comparison was made of the adsorption and desorption characteristics of sulfur on catalysts active in carbon disulfide synthesis: nickel oxide, nickel sulfide, and vanadium pentoxide. Each catalyst was supported on high-area alumina and investigated from 600 to 700 C. The results for each system bear similarities, but important differences were noted. Although supported nickel oxide is a good adsorbent for sulfur, it would not produce carbon disulfide as a product until the metal oxide had first been converted to the sulfide by conditioning with sulfur. Sulfur dioxide produced during this conditioning would probably have a deleterious effect on the ultimate formation of CS2. The kinetics of adsorption are greater than first order in the initial stages. In contrast, the adsorption of sulfur on nickel sulfide and vanadium pentoxide is strictly first order and also reversible. Differences between the isosteric heats of adsorption of these two adsorbents suggest that the bond formed with sulfur at the surface of NiS is possibly covalent, or may even involve weak dispersive forces, while that at the surface of vanadium is ionic. Estimation of the entropy losses on adsorption indicates that adsorbed sulfur is more mobile on nickel sulfide than on vanadium pentoxide.

4848 APTIC NUMBER 14238

Topol, L. E., R. A. Osteryoung, and J. H. Christie
STUDIES OF ACID-BASE EQUILIBRIA IN MOLTEN ALKALI NITRATES. J. Phys. Chem., 70(9):2857-2862, Sept. 1966. 17 refs.

Voltammetric and chronopotentiometric measurements as well as chemical equilibrium studies were made on the acid solutions S2O7(2 minus), HSO4(minus), and NO2 and on the bases NO2(minus), NO, CO3(2 minus), O(2 minus), OH(minus), and O2(2 minus) in molten NaNO3-KNO3 (50:50 mole%) at 275-350 deg. The existence of the species NO2(plus), postulated to exist in acidic nitrate metals, could not be confirmed. Instead, the addition of a strong acid resulted in the formation of a species similar chemically and electrochemically to dissolved NO2. This species could be reduced in a one-electron process to NO2(minus) but could not be oxidized. (Author abstract modified)

4849 APTIC NUMBER 13957

Turkdogan, E. T. and R. L. Pearce
KINETICS OF SULFUR REACTION IN OXIDE MELT-GAS SYSTEMS. Trans. AIME (Am. Inst. Mining, Metallurgical, and Petroleum Engr.), vol. 227:940-949, Aug. 1963. 16 refs.

The rates of sulfurization and desulfurization of calcium aluminate, silicate, and ferrite melts by CO plus CO2 plus SO2 mixtures at 1550 C are reported. It was shown that for melts 10 to 15 mm deep, transport of sulfide ions within the melt controls the rate of sulfur transfer. The rate data from shallow melts, i.e., 1 to 4 mm deep, were analyzed on the basis of diffusion or a reaction-controlled process and indications are that both processes may play a part in controlling the rate of sulfur reaction. The rates of desulfurization of silicate and aluminate melts increase with increasing P(CO2)/P(CO) ratio in the gas stream, the effect being most marked for aluminate melts. The sulfide equilibrium data obtained from the present work are shown to be in accord with the results of previous studies. It was shown that carbon dioxide has a measurable solubility in silicate, aluminate, and ferrite melts. The rapid rate of sulfurization of iron silicate melts, followed by reversion of the sulfur reaction, was shown to be due to the oxidation of divalent iron to the trivalent state occurring simultaneously with the sulfur reaction. After the first initial rise in the sulfur content of the melt, the rate of desulfurization was controlled by the rate of oxidation of iron from Fe(II) to Fe(III), so that a partial equilibrium is maintained during the approach to ultimate equilibrium in the system.

4850 APTIC NUMBER 13956

Turkdogan, E. T. and L. S. Darken
SULFUR EQUILIBRIA BETWEEN GASES AND CALCIUM FERRITE MELTS. Trans. AIME (Am. Inst. Mining, Metallurgical, and Petroleum Engr.), vol. 221:464-474, June 1961. 31 refs.

Calcium ferrite melts were equilibrated with sulfur-and oxygen-bearing gases at temperatures within the range of 1290-1620 C. The results show that at oxygen partial pressures below 0.0001 atm, the sulfur dissolves in the melt as sulfide ions by replacing an equivalent number of oxide ions. With increasing oxygen partial pressure, the sulfide ions are converted to sulfate ions and some oxygen dissolves in the melt. It is also observed that when the square root of p(SO2)xp(O2) increases, sulfate ions are converted to pyrosulfate ions and the results permit the evaluation of the pyrosulfate/sulfate ratio. For the sulfate reaction, the results show that the equilibrium constant increases with increasing concentration of calcium oxide and decreasing temperature and the heat of reaction decreases with increasing calcium oxide concentration. The results for the sulfide reaction show that the equilibrium constant increases with increasing concentration of ferrous oxide or calcium oxide and increasing temperature. The ratio of CaSO4 activity to CaO activity increases with decreasing concentration of calcium oxide in calcium ferrite, silicate, and aluminate melts. Indications are that oxy-acids increase the activity of CaSO4. Experiments were carried out within the sulfide range and the results were in accord with those obtained by other investigators on aluminate and silicate melts.

4851 APTIC NUMBER 14090

Umetsu, Yoshiyuki and Shinichiro Suzuki
ON THE DECOMPOSITION OF ZINC FERRITE BY ROASTING IN SO2-O2-N2 ATMOSPHERE. (Atetsu aen no SO2-O2-N2 funiki ni yoru bunkai). Text in Japanese. Nippon Kogyo Kaishi (J. Mining Met. Inst. Japan), vol. 68:529-532, 1952. 4 refs.

Zinc ferrite is easily decomposed by roasting from 600 to 800 C in an SO2-O2-N2 atmosphere; the roasting temperature is dependent on the partial pressure of SO2 in the atmosphere. Zinc sulfatizes more rapidly than iron. Although the formation of water-soluble iron decreases with a rise in roasting temperature, a certain amount of iron is still soluble at high temperatures. (Author abstract modified)

4852 APTIC NUMBER 14236

Van Artsdalen, E. R., Duane Brown, A. S. Dworkin, and F. J. Miller
SELF-DIFFUSION IN MOLTEN SODIUM NITRATE. J. Am. Chem. Soc., vol. 78:1772-1773, April 20, 1956. 6 refs.

Self-diffusion coefficients of sodium and nitrate ions in fused sodium nitrate between 315 and 275 deg were measured by the capillary method as a function of temperature. Results indicate that the heat of activation for self-diffusion is independent of temperature in the range studied and is the same for both anion and cation within plus or minus 0.1 to 0.2 deg. The ratio of the absolute rates of self-diffusion of the two ions is approximately, but not exactly, proportional to the inverse square roots of the masses. Electrical conductance of fused sodium nitrate does not appear to obey the Nernst-Einstein equation.

4853 APTIC NUMBER 13959

Volpicelli, Gennaro and Antonio Rosato
THERMODYNAMIC EQUILIBRIA OF THE SYSTEMS: CA(OH)2-H2O-SO2 AND CACO3-H2O-SO2. (Sugli equilibri termodinamici dei sistemi: Ca(OH)2-H2O-SO2 e: CaCO3-H2O-SO2). Text in Italian. Rend. Accad. Sci. Fis. Mat. (Soc. Nazl. Sci., Napoli), 30(4):343-352, Dec. 1965. 4 refs.

Thermodynamic equilibria of the systems obtained by the reactions between H2O-SO2-Ca(OH)2 and H2O-SO2-CaCO3 were studied. These are of interest in two main processes of bisulfite acid manufacturing using, respectively, milk of lime and limestone as raw materials. On the basis of phase rule, variances of the systems were defined and compositions of phases in equilibrium were calculated. (Author summary modified)

4854 APTIC NUMBER 14303

Von Semel, Georg and Heinz Lehmann
METHOD OF PRODUCING CONCENTRATED MIXTURES OF NITRIC AND PHOSPHORIC ACID. (Pintsch Bamag A.-G., Berlin) U. S. Pat. 2,901,340. 2p., Aug. 25, 1959. 4 refs. (Appl. Dec. 26, 1956, 7 claims).

A method was devised for obtaining higher concentrations of mixtures of nitric and phosphoric acids by using a phosphoric acid solution instead of water. The method consists of passing a nitrogen oxide gas and an oxygen-containing gas into a dilute phosphoric acid solution with an inorganic nitrate or sulfate salt dissolved in it in an amount between 1% by weight and the solubility limit of the salt. The nitrogen oxide gas absorption is promoted by the inorganic salt which converts it to nitric acid. Thus, a concentrated solution of phosphoric and nitric acid is formed.

4855 APTIC NUMBER 14166

Wallace, F. J. and P. V. Langell
THEORETICAL AND EXPERIMENTAL ANALYSIS OF AIR AND GAS FLOWS IN A CRANKCASE SCAVENGED TWO-STROKE ENGINE EMPLOYING BOOST PORTS. Preprint, Society of Automotive Engineers, Inc., New York, 24p., 1969. 8 refs. (Presented at the International Automotive Engineering Congress, Detroit, Mich., Jan. 13-17, 1969, Paper 690134.)

A complex flow system consisting of three interconnected volumes with piston controlled ports and an external exhaust system was analyzed using quasi-steady flow equations for all port flows, the method of characteristics for the exhaust flow duct, and the unsteady flow energy equation, perfect gas state equation, and perfect mixing assumptions for all volumes. The chief advantage of the method of characteristics over conventional acoustic treatment is that of much greater accuracy, particularly for pressure waves of substantial amplitude, due to the inclusion of the convective term as well as appropriate friction, area change, and entropy discontinuity terms in the continuity and momentum equations. The method consists of solving a hyperbolic partial differential equation of continuity, momentum, and energy. The results showed satisfactory overall correlation between theoretical and experimental air consumption trends. The inclusion of equations expressing changes in chemical composition of the gases led to valuable insights into the scavenging behavior of the engine. Charge purity and trapping efficiency both decreased markedly with increasing engine speed and could be improved only by careful exhaust and inlet tuning, which was not attempted. The analysis provided a valuable tool in optimizing port areas and timings that otherwise could be achieved only by lengthy trial and error procedures. The boost ports and chambers that constituted a special feature of the test engine were incidental to the results but provided a further test for the generality of the theoretical analysis and the computer program developed from it.

4856 APTIC NUMBER 14317

Warneck, Peter
PHOTODETACHMENT OF NO2(-). Chem. Phys. Letters (Amsterdam), 3(7):532-533, July 1969. 10 refs.

The photodetachment of electrons from NO2(-) ions by light in the violet portion of the visible spectrum was observed. Negative ions were extracted from a discharge source, accelerated to a speed of about 6,000,000 cm/sec, collimated, and mass separated in a 90 degree, stigmatically focusing magnetic analyzer. After passing the photodetachment chamber, the ions were trapped and discharged in a Faraday cup. Photoelectrons were withdrawn at right angles by a weak electric field and were detected with a venetian blind electron multiplier. The signal was processed by a phase sensitive amplification and was displayed on a strip chart recorder. The apparent photodetachment threshold is approximately 4740 A, which corresponds to an energy of 2.74 eV. The derived threshold energy provides only a lower limit to the vertical detachment energy because a portion of the NO2(-) ions are vibrationally excited. Subsequent to the formation of a negative ion in the discharge, the ion drifts toward the anode, picking up energy in the electric field and losing energy by collisions. This mechanism leads to a quasi-Boltzmann vibrational energy distribution among the ions equivalent to an estimated temperature of several thousand degrees. The excess vibrational energy cannot be dispersed because the radiative lifetime of the involved states is about one hundred times greater than the transit time of the ions in the apparatus. A semi-logarithmic plot of photoionization cross sections versus energy of ground state molecules, as compared to that of vibrationally excited ones, often indicates the beginning photoionization by a break in the cross section curve. A break occurred at 3.10 eV and was identified as the first ionization potential of NO2(-), so that 3.10 eV is the electron affinity of NO2. These results provided the first direct determination of the electron affinity of NO2.

4857 APTIC NUMBER 14312

Wieden, P. and H. Balduin
GAS ADSORPTION ON BENTONITES. (Gasadsorption an Bentoniten). Text in German. Kolloid-Z. (Germany), 127(1):30-32, 1952. 5 refs.

The adsorption of gases such as N2, CO2, SO2, NH3 on Austrian bentonites was studied at 20 C at pressures up to 700 mm Hg. The isotherms could best be expressed by Langmuir's formula; a lattice adsorption can thus be assumed. The two gases NH3 and SO2 were particularly strongly adsorbed. Preliminary thermal treatment of the bentonites showed that the highest amount of gas was adsorbed at 100 C, after which adsorption of the two gases declined with rising temperatures. This fact can be explained by two different mechanisms acting above and below 100 C drying temperatures. In vacuum drying below 100 C, the parallel silica flakes are covered by 0.3 mm-thick water layers which absorb gases readily. At higher drying temperatures, the water layer disappears and the absorption decreases. The marked differences are less pronounced if the gas molecules have a strong affinity for water, like CO2 and NH3. The adsorption properties change again if the drying temperature is raised to 500 C, because then water of crystallization is released. Since bentonites, being a form of montmorillonites, represent a transition between a gel and pyrophyllite, the actual structure may be more complicated than simple parallel flakes. The adsorption properties, as well as x-ray diffraction properties, must be considered as statistical mean values which could be explained by different structural concepts.

4858 APTIC NUMBER 14204

Wrench, D. M. and D. Inman
A CHRONOPOTENTIOMETRIC INVESTIGATION OF THE DISSOCIATION OF SULPHATE IONS IN MOLTEN EQUIMOLAR NACI-KCL AT 750 C. Electrochim. Acta, 12(12):1601-1608, 1967. 7 refs.

The Lux-Flood acid-base equilibrium SO3 plus O(2-) yields SO4(2-) in molten equimolar NaCl/KCl at 750 C was investigated using conventional chronopotentiometry. The equilibrium constant for the reaction was very high. Thus, the sulfate ion in solution in the melt does not decompose unless a very strong acid such as metaphosphate ion is added to the melt. This removes oxide ions according to the reaction 2PO3(-) plus SO4(2-) yields SO3 plus P2O7(4-). The pyrophosphate anion is not a sufficiently strong acid to remove oxide from sulfate. (Author abstract modified)

4859 APTIC NUMBER 14100

Wyatt, P. A. H.
METHODS FOR CALCULATING THE EXTENT OF DISSOCIATION OF COMPOUNDS IN THE LIQUID STATE. Trans. Faraday Soc., vol. 52:806-815, Jan.-June 1956. 21 refs.

A straightforward application of Raoult's law to the dissociation of a compound in the liquid state shows that explicit values of the extent of dissociation (alpha) can be calculated from experimental estimates of the first and second differential coefficients or the corresponding vapor-pressure derivatives. When the form of dissociation is uncertain, the quantity alpha(a plus b)/abm can be determined, in which a and b are the numbers of particles produced in solution per molecule of the two primary dissociation products, and m is the number of molecules of the compound involved in the dissociation equation. For compounds of small dissociation, a and b can be evaluated by a combination of freezing-point and partial molar heat content data, thus supplementing the methods already in use. For compounds of large dissociation, cryoscopic data can be used to test whether or not dissociation is complete. (Author abstract modified)

4860 AFTIC NUMBER 14072

Yesin, O. A., P. V. Gel'd, and S. I. Popel'
REDISTRIBUTION OF IONS DURING THERMAL DISSOCIATION OF DOUBLE SALTS. (Protsess pereraspredeleniya ionov pri termicheskoy dissotsiatsii dvoynykh soley). Text in Russian. Zh. Prikl. Khim., 22(4):354-360, 1949. 5 refs.

The thermal dissociation of dolomite ($CaMg(CO_3)_2$) was used to study the redistribution of ions, in this case those entering into the new solid phases, $CaCO_3$ and MgO. It is revealed that redistribution becomes possible through the disintegration of gaseous products, in this case CO_2. Linked with significant redistribution of ions within the crystal lattice, it determines the slower decomposition rate of dolomite as compared with pure carbonates with identical deviation from the equilibrium state. The weak acceleration of dolomite decomposition by the solid decomposition products and the strong effect of alkali metal salts underscores the fact that more important than development of nuclei of new phases is the gradual addition of material to them, i.e., the process of ion transfer. This is substantiated by the large number of crystals of the new phases forming in the presence of $NaCl$. The latter, accelerating the transfer of ions, also makes probable the dissociation of dolomite into separate carbonates, thereby reducing the temperature at which this dissociation takes place.

4861 APTIC NUMBER 14079

Abe, Mutsuo
EFFECTS OF MIXED NO2-SO2 GAS ON HUMAN PULMONARY FUNCTIONS. Bull. Tokyo Med. Dental Univ., 14(4):415-433, 1967. 30 refs.

Experimental studies were carried out on the effects of SO2, NO2, and a mixed SO2-NO2 gas on the human pulmonary functions by measuring the values of ventilatory mechanics, by spirometry, and by peak flow rate. The effects of SO2 are immediate but not durable. Those of NO2, on the contrary, are late-acting and durable. The effects of a mixed SO2-NO2 gas are intermediate between those of NO2 and SO2 alone, showing no cumulative effects of the two gases, only additive ones. Such differences of the effects between two gases are supposed to be attributed to the grade of water solubility of each gas; SO2 is readily soluble and NO2 difficultly soluble. (Author abstract modified)

4862 APTIC NUMBER 14112

Balazova, G. and A. Rippel
A STUDY OF THE HEALTH CONDITIONS OF THE PEOPLE LIVING AROUND AN ALUMINUM FACTORY. (Studio sulle condizioni di salute della popolazione abitante nelle vicinanze di una fabrica di alluminio). Text in Italian. Med. Lavoro (Milan), 59(5):376-380, 1968. 4 refs.

The physical condition of children living in the area of an aluminum factory was studied. Ambient air around the factory was heavily polluted by fluorine and high concentrations of fluorine were present in the agricultural products of the region. In the children examined, absorption of fluorine by digestive and respiratory systems was approximately 2.15 mg/day. In contrast to children living considerable distances from the factory, these children showed marked increases in the fluorine content of their teeth, nails, hair, and urine. Clinical and laboratory studies indicated a moderate decrease of hemoglobin values and a slight increase of red blood cells among the affected children.

4863 APTIC NUMBER 14064

Ballenger, J. J., C. R. McFarland, H. B. Harding, M. Koll, and D. Halstead
THE EFFECT OF AIR POLLUTANTS ON PULMONARY CLEARANCE. Laryngoscope, 78(8):1367-1397, Aug. 1968. 22 refs. (Presented at the Seventy-First Annual Meeting of the American Laryngological, Rhinological and Otological Society, Inc., Hollywood Beach, Fla., April 21-23, 1968.)

To investigate the experimental effects of influenza B virus both alone and with nicotine, the rotating explant method was used. In this method, explants of human ciliated epithelial cells are held by a chicken plasma clot in an air- and water-tight Rose chamber. The explants rotate bacause of metachronous ciliary activity. Rotation speed compared to base line speed forms a reliable index of ciliary activity. The results show that reduced nicotine and oxidized nicotine stimulated the rotating explants within the first 30 minutes of exposure; afterward, a gradual decrease in activity was observed. This decrease in activity was more pronounced with oxidized nicotine in the system, which showed a change from the base line speed after four hours to be minus 14%. Infection of the explant with influenza B virus 12 to 24 hours before exposure to nicotine enhances the ciliostatic effect of the nicotine. It is believed that this may represent the modus operandi of the aggravation of an existing virus infection by exposure to cigarette smoke.

4864 APTIC NUMBER 14319

Cavagna, G., G. Locati, and L. Ambrosi
EXPERIMENTAL STUDIES IN NEWBORN RATS AND MICE ON THE SUPPOSED CAPILLARY-DAMAGING EFFECTS OF FLUORINE AND FLUORINE-CONTAINING INDUSTRIAL POLLUTANTS. Med. Lavoro (Milan), 60(4):267-273, 1969. 12 refs.

Bluish skin-spots occurring in women and children living in the vicinity of a fluorine-emitting aluminum factory have been attributed to a poorly understood capillary-damaging effect of fluorine. To clarify this phenomenon, a study was carried out on rats born of mothers which were injected subcutaneously for the whole pregnancy period with NaF and an extract of dust emitted from the aluminum factory at a dose of 2 mg fluorine per day. The total dose of fluorine given was 40-52 mg. No cutaneous lesions, or even an increased capillary fragility of the skin, as proved with the suction cup test were observed. In a second experiment, newborn rats were injected subcutaneously with NaF and the dust extract at a dose of 0.2 mg fluorine per day in the first 10 days of life. Again no cutaneous lesions or increased capillary fragility of the skin were observed. Studies on subacute toxicity were carried out in female mice injected subcutaneously with NaF and with the dust extract in a dose of 0.2 mg fluorine per day for 24 days. No cutaneous lesions or capillary alterations as studied in histologic preparations of the mesentery were observed. (Author summary modified)

4865 APTIC NUMBER 13960

Deynega, V. G.
THE SIGNIFICANCE OF THE ADRENALS IN THE EFFECT OF METHANE-OXYGEN HYPOXIC GAS MIXTURES. (O znachenii nadpochechnikov pri vozdeystvii metano-kislorodnoy gipoksicheskoy gazovoy smesi). Text in Russian. Gigiena Truda i Prof. Zabolevaniya, 13(3): 57, 1969.

Groups of white rats were exposed to a hypoxic mixture of gas with a composition approximating that of firedamp after various preliminary treatments. The gas mixture consisted of 87% methane, 4% ethane, trace amounts of propane, butane, nitrogen, krypton, and 6% oxygen. The control group was untreated; the second group consisted of 10 rats which were adrenalectomized; the third group consisted of 9 rats which were laparotomized with the adrenals left intact; the fourth group consisted of 9 rats which received 30 mg/kg hydrocortisone 20 min before being exposed to the firedamp gas; and the fifth group consisted of 11

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rats which received 40 units/kg of ACTH 20 min prior to exposure. Behavior of the animals, frequency of respiration, oxygen consumption, and survival time were monitored in all groups. After a few minutes, the animals developed increased motor activity, respiration increased in frequency, and there were other signs of irritability. After 1-2 hrs, the animals were sedated, respiration was still rapid, and death resulted in about 4 hrs. Survival time was half as long in the adrenalectomized rats as in the controls and oxygen consumption was increased. There was a slight increase in resistance to the hypoxic gas in laparotomized animals. Survival time in animals given hydrocortisone was significantly higher--429 plus or minus 27 min versus 237 plus or minus 16 min in the controls. ACTH had no effect on survival.

4866 APTIC NUMBER 14078

El-Attar, Osamah Amin
EFFECT OF CARBON MONOXIDE ON THE WHOLE FIBRINOLYTIC ACTIVITY.
Ind. Med. Surg., 37(10):774-777, Oct. 1968. 17 refs.

A study of whole fibrinolytic activity was conducted in 21 cases of acute carbon monoxide poisoning and 28 cases of repeated carbon monoxide exposure and 15 control group subjects. Rise of whole fibrinolytic activity among cases of acute carbon monoxide poisoning was significant. Moderate rise was noticed more in the repeated carbon monoxide exposure group than in the control group. The results suggest that whole fibrinolytic activity should be periodically measured among workers exposed to carbon monoxide. When the fibrinolytic activity is highly elevated, maximum allowable concentration of carbon monoxide in the working environment should be lowered, and medical treatment must be given to workers.

4867 APTIC NUMBER 12555

Firket, J.
COMPARATIVE PATHOLOGY AND AIR POLLUTION. ((Pathologie comparee et pollutions atmospheriques.)) Text in French. Congr. Intern Pathol. Com., 7th Lausanne, 26-31st May 1955. 7(2):57-80.

Air pollution factors include the chemical action of gases and vapors, the physical action of particle suspensions (aerosols), and the reaction of certain pollutants turning harmless gases into toxic ones. This report stresses the pathological aspects of air-pollution poisoning as evidenced by the fatal accidents in Belgium (1932), Donora, Pa. (1948), and London (1952), where geographical and meteorological factors helped in the formation of a fog umbrella and critical pollutant concentrations over the area. Physiological effects of certain gases and vapors in industrial atmospheres are shown in Table I. The penetration of dusts into the lungs depends upon their sizes (micronic, submicronic, submicroscopic) and on the presence of fog. The pathogenic action begins with an irritation of the respiratory mucous membranes, slow paroxystic expiration, followed by vascular collapsus, low blood pressure. Postmortem toxicological tests were negative. Fog induced asthma and emphysema have affected Belgian cattle since 1911. Goats, sheep and cattle have contracted fluorosis from fluorine and fluorine dusts discharged into the air by industry. Sheep in the vicinity of a fluorine processing plant developed dental and osseous lesions. Other aspects of "civilization sicknesses" arise from our changing environment, the use of insecticides on vegetation, the presence of smokes, gases, fluorine in the air. The relation of air pollution to primary lung cancers is considered for certain trades and professions. Statistics seem to indicate tobacco smoke (in cigarettes) to predispose to lung cancer, without, however, determining it.##

4868 APTIC NUMBER 13961

Fisher, Russell S.
RESEARCH ON NEUROPATHOLOGICAL EFFECTS OF MILITARY CHEMICALS. AN EXPERIMENTAL INVESTIGATION IN ANIMALS OF THE FUNCTIONAL AND MORPHOLOGICAL CHANGES FROM SINGLE AND REPEATED EXPOSURES TO CARBON MONOXIDE. (Final Report). Maryland Univ., University Park. Dept. Army, Contract DA 18-108-405-CML-754, 6p., Dec. 1, 1962.
AD 282923

Carboxyhemoglobin and oxygen saturation determination, electrocardiograms, and histological examinations of brains and hearts are reported for dogs exposed for varying periods of time to 50 and 100 ppm of carbon monoxide and under the condition of pure hypoxia. The data show that chronic exposure to even 50 ppm levels of CO produces not only functional disorders but also morphologic changes in brain and heart. The amount of carboxyhemoglobin in dogs exposed to 50 ppm averaged 2.6 to 5%; that in dogs exposed to 100 ppm, 7 to 12%. Oxygen deficiency produced by pure hypoxia was similar to deficiency produced by CO. Edema of the central nervous system and hyperemia of the internal organs were observed in animals who died shortly after exposure to CO. There were no grossly visible alterations in the brains of animals who survived longer than 24 hrs, but autopsies revealed dilation of the heart ventricles, particulary the right. Histologic alterations in the brains ranged from microglial reactions and proliferation of capillary cell elements to tissue necrosis in animals exposed to 100 ppm levels of CO. It is concluded that tissue necrosis in the brain depends both on hyperemia and on the location and duration of a secondary circulatory disorder to which insufficiency of the right heart contributes. It is further suggested that man might be adversely affected by exposure to these concentrations of CO.

4869 APTIC NUMBER 14035

Gildenskiold, R. S., F. I. Dubrovskaya, and M. S. Katsenelenbaum
EFFECT OF INDUSTRIAL DISCHARGES ON THE POPULATION'S HEALTH IN RELATION TO INTENSITY AND DURATION OF THE EFFECT. (Vliyaniye promyshlennykh vybrosov na zdorov'ye naseleniya v zavisimosti ot ikh intensivnosti i vremeni vozdeystviya). Text in Russian. Gigiena i Sanit., no. 7:13-16, 1969. 4 refs.

Comparative data are presented on the discharge of atmospheric pollutants from a chemical plant and a thermoelectric power station and their effect on the health of a population of children. A more pronounced noxious effect from the polluted atmosphere was noted if the intensity of pollution was low but its duration was long. (Author abstract modified)

4870 APTIC NUMBER 14149

Goetz, Hanz and Norbert Klueken
THE EFFECT OF AIR POLLUTION (IMMISSION SUBSTANCES) IN INDUSTRIAL AREAS ON THE SKIN. (Ueber den Einfluss von Luftverunreinigungen auf die Haut. Untersuchungen mit Immissionstoffen im Industriegebiet). Text in German. Muench. Med. Wochschr. (Munich), 111(18):1021-1027, May 2, 1969. 41 refs.

Air pollution is progressively becoming a more significant health problem. The skin, which is the contact and defense organ of humans against the environment, was studied. The results are reported of 11,922 skin tests with dust samples from the Ruhr area in patients who did not suffer from eczema. It was found that skin irritations in the form of inflammatory erythema and follicular swelling may occur in healthy individuals. The probability of producing dermal reactions was increased in proportion to the sulfate, chloride, and ammonia fractions. In patients with psoriasis, it was possible in two cases to induce psoriasis efflorescences in the sense of Koebner's irritation phenomenon at the point of contact of the emission substances. However, the test series failed to disclose results which could be regarded as genuine allergic reactions. (Author summary modified)

4871 APTIC NUMBER 14040

Goldsmith, John R.
NONDISEASE EFFECTS OF AIR POLLUTION. Environ. Res., 2(2):93-101, Feb. 1969. 33 refs.

The importance of nondisease effects of air pollution as an aspect of air pollution epidemiology is discussed, and the need to extend laboratory demonstrations of these effects to field application is pointed out. Such phenomena are considered to be effects on body organs and systems and on physical performance that, at least in the short run, are not associated with disease. For example, eye irritation is cited as the most widespread symptom of photochemical pollution, affecting about three-fourths of the population of Los Angeles County, yet no known disease of the eye is associated with it and so far the symptom cannot even be clearly associated with a single pollutant. Again, because of the effect of carbon monoxide on temporal discrimination, a possible relationship between motor vehicle accidents and carbon monoxide exposure is suggested for investigation. Studies of the reaction of the respiratory system to air pollution that use laboratory techniques such as measurements of airway resistance, pulmonary compliance, and diffusion capacity in epidemiologic studies are reviewed. The possible application of sputum histamine and sputum cytologic tests and measurements of carboxyhemoglobin to define the effect of carbon monoxide on hemoglobin transport of oxygen are also discussed. Two principles for drawing substantive conclusions are given. The first is that environmental measurements of a high level of validity with respect to population exposure must be collected at the same time and place as population reactions are studied. The second principle is that whenever possible, population reactions should be compared under contrasting temporal and spatial conditions. Some data on nondisease effects in the United Kingdom and the United States, particularly California, are presented.

4872 APTIC NUMBER 14050

Gregory, Arthur R. and Charles H. Hine
NEONATAL RESISTANCE TO LUNG EDEMA. Proc. Soc. Exp. Biol. Med., vol. 128:693-695, July 1968. 15 refs.

The resistance of newborn rats and mice to lung edema was determined by simultaneously injecting adult rodents and their newborn offspring with thiourea and by comparing the toxicity of inhaled NO2 in adults and newborn. Newborn rodents survived injections in good health but the mothers, in grooming their young, ingested fatal amounts of thiourea. Their deaths were characterized by pulmonary edema and hemorrhage. The median lethal dose (LD50) of thiourea for adult rats was 47 mg/kg; that for newborn rats was 1.2 gm/kg. Resistance to NO2 was also high in the young. These results are in direct contrast to both original data and data from the literature on the ordinarily increased sensitivity of newborn animals to most drugs and toxic agents. It is theorized that immaturity of the pituitary-adrenal axis, together with thyroid deficiency and thyroid insensitivity, is important in the resistance of newborn animals to these inducers of lung edema. Hypoventilation is also suggested as a possible protective mechanism.

4873 APTIC NUMBER 14323

Hirano, Hideo, Yugen Inoue, and Junichiro Tamami
STUDIES ON THE MODE OF ACTION OF CARBON MONOXIDE. 1ST REPORT: CHANGES OF PERCENTAGE SATURATION OF CARBOXYHEMOGLOBIN AND OF BLOOD SUGAR LEVELS DURING INHALATION OF CARBON MONOXIDE. (Ichisanka tanso no sayo kijo ni kansuru kenkyu (dai 1 ho) Teinodo ichisanka tanso kyunyu go no CO-Hb howado no henka oyobi kettochi ni tsuite). Text in Japanese. Nippon Eiseigaku Zasshi (Japan J. Hyg.), 22(6):559-562, Dec. 1967. 28 refs.

The physiological effects of inhaled carbon monoxide on rabbits is described. Changes were noted in the saturation level of carboxyhemoglobin and in blood sugar levels. A flexible film isolator for raising germ-free animals was used to allow the desired concentration of CO to flow through the chamber. The peak saturation pressure of carboxyhemoglobin was observed for about 30-60 min during inhalation of 100 ppm CO concentrations. The value decreased by half after 3 hrs, even though the animals still breathed the same concentration of CO. Epinephrine administered to check the influence of carbon monoxide had no effect. Inhalation of 100 ppm CO caused an increase in blood sugar levels with a maximum observed after inhalation for 90 min. The continuation of hyperglycemia appeared even after the discontinuation of inhalation of carbon monoxide at 300 ppm levels. (Author abstract modified)

4874

APTIC NUMBER 14175

Holland, W. W., H. S. Kasap, J. R. T. Colley, and W. Cormack
RESPIRATORY SYMPTOMS AND VENTILATORY FUNCTION. A FAMILY STUDY.
Brit. J. Prevent. Social Med. (London), 23(2):77-84, May 1969.
17 refs.

The purpose of the paper was to determine the effects of age, sex, smoking habits, area of residence, social class, and domestic environment on respiratory symptoms and ventilatory function in parents and children. Two areas were chosen to provide a range of environmental conditions that might be related to respiratory disease with Area 1 having a higher density of persons per acre and per room than Area 2. The sample population consisted of families who had a baby born between July 1, 1963 and June 30, 1965, a total of 2206 families. It was found that in both fathers and mothers, present smokers had a higher incidence of respiratory symptoms than non- and ex-smokers. In non-smokers, there was a social class gradient for winter morning cough in fathers only. In fathers, there was no difference in symptom prevalence within social class and smoking category between the two study areas. In mothers and children, symptom prevalence was higher in Area 1 than in Area 2 for present and non-smokers. In fathers and mothers, non-smokers had a higher peak expiratory flow rate than present smokers, but these differences were not significant. There were no social class or area differences in the peak expiratory flow rate measurement in fathers, mothers, or children. It was suggested that exposure to tobacco smoke over a short time span can result in a significant increase in symptom prevalence in non-smokers, than young fathers have not been exposed for a significant length of time to occupational and environmental factors for a social class gradient to be an important factor, and that the absence of a social class gradient in mothers and children suggests that although there may be factors in home environment that have an adverse affect on respiratory disease, they are not related to social class. The lack of a significant difference in ventilatory function between non- and present smokers was attributed to youth.

4875

APTIC NUMBER 14097

Horiuchi, Kazuya, Shun'ichi Horiguchi, Nariaki Tanaka, Kozo Shimagawa, and Takanobu Hamaguchi
MANGANESE CONTENTS IN THE WHOLE BLOOD, URINE AND FECES OF A HEALTHY JAPANESE POPULATION. Osaka City Med. J. (Japan), 13(2): 151-163, 1967. 35 refs.

To obtain fundamental data for the investigation of industrial manganese poisoning, the contents of manganese in the whole blood, urine, and feces of 232 healthy, urban Japanese adults were spectrographically determined. Histograms obtained for each biological material were logarithmically transformed, and the percentages of cumulative frequencies were plotted on normal probability graphs. Statistical analysis indicates that the distribution of manganese contents in the whole blood and urine of the sample population approximates normal logarithmic distribution, so the normal limits established should be valid for a larger population. The upper limit of manganese content in the whole blood was less than 6.73 micrograms per 100g for 95% of the sample; less than 8.8 microgram per 100g for 99%. No statistically significant differences of blood manganese content was observed between males and females. However, seasonal variations were found: manganese levels in the blood are higher in spring and winter, lower in autumn and summer. Upper limits of manganese in the urine of the sample population were 19.1 microgram/l (95%) and 30.2 microgram/l (99%). The manganese content in feces in most specimens was less than 14 mg/day, with a median of 4.1 mg/day.

4876

APTIC NUMBER 13955

Lacey, J.
POTENTIAL HEALTH HAZARDS TO ENGINEERS FROM FUNGUS SPORES.
Preprint, Southampton Univ. (England), Faculty Eng. and Inst. Sound Vib. Res. with Soc. Environ. Eng., p. 245-256, 1967. 11 refs. (Presented at the Technical Meeting on Environmental and Human Factors in Engineering, Southampton, England, April 10-14, 1967.)

The possible hazards to engineers, particularly those involved in mold-resistance testing, of exposure to certain fungi is discussed. The fungus organism and the normal fungus-spore content of the air in different places and circumstances is described. Of the parasitic fungi that the engineer might encounter, Aspergillus fumigatus is the most important. Depending on the resistance of the subject, it can cause respiratory disease of varying severity and, even more likely respiratory allergy, although contact allergy is possible. Allergic response will cause symptoms resembling hay fever, asthma, or farmer's lung disease. Various situations incidental to engineering work have a potential for fungus contamination, including use of mold-deteriorated equipment and work in agricultural environments. General precautions are suggested. Respirators that can retain particles of less than 1 micron diameter should always be worn in spore-laden atmospheres; enclosed cabinets or hoods with air exhaust systems should be used for all fungus manipulations; microbiologists should supervise all testing; test materials should be decontaminated as soon as possible; and good personal hygiene and clean working facilities must be maintained. People with a history of respiratory disease or allergy, diabetics, cancer patients, and those receiving antibiotic or corticosteroid therapy should not work with fungi.

4877

APTIC NUMBER 14126

Macuch, P., J. Kortus, G. Balazova, and J. Mayer
EFFECTS OF SODIUM AND HYDROGEN FLUORIDES ON THE METABOLISM OF FLUORINE, CALCIUM, AND PHOSPHORUS IN RATS. Brit. J. Ind. Med. (London), 25(2):131-135, April 1968. 23 refs.

The effects of oral sodium fluoride and inhaled hydrogen fluoride on calcium and phosphorus retention are presented. Rats given 4 mg fluoride/kg/day for eight days excreted more calcium and phosphorus and retained less than the control group. In bone ash from rats given different fluoride doses for 40 days, the calcium and phosphorus were maximal after a total dose of about 250 micrograms of fluoride/rat but fell to subnormal levels after higher doses. The calcium and phosphorus levels in bone ash from rats given 750 micrograms of fluoride/day fell with the duration of treatment. Rats exposed to 9.4 to 11.7 micrograms of hydrogen fluoride/liter air absorbed fluoride rapidly, as shown by increased urinary excretion, by changes in the tooth enamel, and by rising fluoride levels in the teeth and bones. Radiological examination, however, showed no gross changes. It was evident that fluoride under different conditions affected the metabolism of calcium and phosphorus differently and also that some calcium compounds reduce the toxicity of a high fluoride intake. Fluoride caused the same changes whether given by inhalation or in the diet. The analyses for fluorides in the first samples of urine after an exposure of only three days showed raised levels. Although in the experiment, the concentration of fluoride in the urine in different specimens were variable, the mean concentrations from the series of tests showed as increased excretion with the increased duration of exposure.

4878

APTIC NUMBER 14134

Nishiyama, Keitaro, Mitsuyosi Nagayasu, and Takeo Azuma
STUDIES ON THE PREVENTION OF PUBLIC NUISANCE BY THE EXHAUST GASES FROM THE KRAFT PULP MILL. PART 4. COMPARISON OF INFLUENCES OF ODOR ON THE INHABITANTS OF TWO DIFFERENT AREAS. (KP seishi kojo haigasu no kogai boshi ni kansuru kenkyu dai 4 ho sogyoreki ga kotonaru ni kojo shuhen jumin no shuki ni taisuru ishiki hikaku). Text in Japanese. Shikoku Igaku Zasshi (Shikoku Acta Medica), 24(1):53-57, Feb. 1968. 2 refs.

The influences of bad odor on inhabitants were studied comparatively in areas adjacent to mills designated the K and N mills. Contrary to belief that interest in bad odor would be more active in an area around a newly-founded factory (K) than around an older one (N), no significant differences were noticed in the complaints of the inhabitants of the two areas. However, in the N area, complaints of respiratory disorders were fewer than in the K area. The influence of the time of day, weather, and wind velocity on the degree of bad odor were similar in both areas. A larger number of people in the N area suffered from the odor throughout the year than those in the K area. Sectional differences of the effect were less in the N area than in the K area. This was probably due to the unstableness of the wind direction in the N area. (Author abstract modified)

4879

APTIC NUMBER 14091

Sawicki, Feliks, Jan. Steczkowski, Wieslaw Jedrychowski, and Wladyslawa Maternowska
CHRONIC NONSPECIFIC RESPIRATORY DISEASES IN THE CITY OF CRACOW. III. PILOT STUDY. (Przewlekle nieswoiste choroby ukladu oddechowego wsrod mieszkancow Krakowa. III. Wstepne badanie terenowe). Text in Polish. Przeglad Epidemiol., 22(4):569-574, 1968.

In April and May 1966, a pilot study of respiratory diseases was carried out in one district of Cracow based on the random sampling of 200 dwellings and 547 inhabitants. Of the selected sample, 91% of the dwellings and 90.2% of the persons were examined; chest X-rays, spirometric data, body height, and weight were obtained for 63% of the sample population. On the basis of the adopted diagnostic criteria, chronic bronchitis was diagnosed in 17.8% of the population (24% of the men and 13% of the women). In the course of the pilot study, additional studies were made to assess the source of errors biasing the results. (Author summary modified)

4880

APTIC NUMBER 14156

Spies, H. W.
ENVIRONMENTAL RESEARCH IN LEAD AND SULFUR. Proc. Am. Petrol. Inst., Sect. III, vol. 49:550-563, 1969. (Presented at the Session on Air and Water Conservation, 34th Midyear Meeting, Div. of Refining, Am. Petrol. Inst., May 13, 1969.)

Several research projects in lead and sulfur effects sponsored by the American Petroleum Institute are reviewed. A study of the effects of SO2 and dust exposure on rats was completed. With increasing times of SO2 exposure, there was a marginal effect with some diminution of ciliary activity after four weeks and some recovery of ciliary function after 8-12 weeks of exposure. The effects of air pollution on individuals with chronic respiratory disease was the subject of another study. Sulfur dioxide and particulates were monitored, and a correlation was found between high levels of pollutants and conditions of atmospheric inversion phenomena as demonstrated by a higher incidence of respiratory symptoms in individuals over 55 with chronic pulmonary disease. A study on the standards for lead in ambient air showed that the only effect on a subject exposed to lead was a slight increase in the amount of lead excreted during the latter part of the exposure. Another study on lead in air, plants, and soil as influenced by proximity to highways showed that there is a rapid decrease in concentrations of lead in the air and in the first 100 ft from the highway and that concentrations are highest in September and January. It was also reported that there would be a continuation and expansion of a study of urban lead levels. Blood and urine specimens will be taken from individuals and analyzed for lead content. In another study not yet completed, volunteers will be exposed to 10 micrograms of lead/cu m of air for 22 hours a day, seven days a week, for a period of 16 weeks. Biological specimens will be taken from them and analyzed. (Author abstract modified)

4881

APTIC NUMBER 13995

Steinborn, J.
LIVER DAMAGE BY SOLVENTS AND THEIR LABORATORY DIAGNOSIS. (Leberschaeden durch Loesungsmittel und ihre labordiagnostische Erfassung). Text in German. Zentr. Arbeitsmed. Arbeitsschutz, 19(6):168-174, June 1969. 30 refs.

Liver injuries by solvents are known from investigations and intoxications with halogenated hydrocarbons. However, other hydrocarbons and solvents from the series of alcohols, aldehydes, others, esters, as well as sulfur- and nitrogen-containing compounds, can produce changes in the liver parenchyma. Their effects are compiled in this review article, together with laboratory diagnostic methods.

4882 APTIC NUMBER 14077

Vandenbergh, E., L. Billiet, K. P. Van De Woestijne, and A. Gyselen
RELATION BETWEEN SINGLE-BREATH DIFFUSING CAPACITY AND ARTERIAL BLOOD GASES IN CHRONIC OBSTRUCTIVE LUNG DISEASE. Scand. J. Resp. Dis. (Copenhagen), 49(2):92-101, 1968. 33 refs.

The relations between the single-breath diffusing capacity at rest and the arterial blood gases during rest and exercise were investigated in 44 patients with advanced chronic obstructive lung disease and were compared to the findings in 33 patients with pulmonary fibrosis and/or granulomatosis. Low carbon monoxide diffusing capacity (D(CO)) values were associated with a fall of oxygen saturation ($S(O_2)$) on exercise in chronic obstructive lung disease, as well as pulmonary fibrosis. Moreover, this relationship was statistically comparable in both groups of patients. The obstructive group was, nevertheless, distinct from the fibrosis group in showing a weak but significant correlation between low D(CO) and increase of arterial carbon dioxide pressure with exercise. However, multiple regression demonstrated that hypoventilation was not the most important cause of exercise-induced hypoxemia in the obstructive cases with a low D(CO). The association of a reduced D(CO) with a fall of $S(O_2)$ on exertion was more frequent in those obstructive patients thought to have extensive emphysematous lung destruction. The findings demonstrate that even in chronic obstructive lung disease, the results of single-breath D(CO) measurements are meaningful and provide support for their use in the assessment of patients with this disease. (Author abstract modified)

4883 APTIC NUMBER 14065

Weiner, N. D., M. Amanat, D. Blondo, R. Caprioli, M. Dinerman, and A. Felmeister
INTERACTION OF NO_2 WITH MONOLAYERS OF PHOSPHOLIPIDS EXTRACTED FROM E. COLI AT 15 AND 37 DEGREES. J. Pharm. Sci., 57(8):1398-1400, Aug. 1968. 10 refs.

The purpose of the study was to determine whether the membrane phospholipids extracted from Escherichia coli grown at 15 and 37 deg would exhibit differences in their interaction with an air pollutant such as NO_2. The fatty acid residues of the 15 deg phospholipids were found to be considerably more unsaturated than the 37 deg phospholipids. These phospholipids were spread as monomolecular films and exposed to NO_2-containing atmospheres. Whereas the 37 deg phospholipid films showed no interaction, NO_2 was found to expand considerably the 15 deg phospholipid films, probably the result of the interaction of NO_2 with the double bonds of the unsaturated fatty acid groups. The results demonstrate that simple changes in environmental conditions may markedly affect the interaction of air pollutants such as NO_2 with biological membranes. (Author abstract modified)

4884 APTIC NUMBER 12546

Wiemann
COPPER POISONING DUE TO FLUE GASES. ((Kupfervergiftungen durch Huttenrauch.)) Text in German. Deut. Tieraerztl. Wochschr., 47:279-281, 1939.

In the fall of 1937 an abandoned copper mine began operation again. The raw ore is processed at the mining site. In spring of 1938 the first damage of trees and plants in the vicinity, obviously due to deposition of flue gases, was observed. Soon afterwards, the first reports of affects on cattle grazing at the nearby meadows were received. One of them most seriously afflicted with the disease was slaughtered and its organs were sent to the veterinary department of the University of Hannover, Germany. It was found that the liver and milt contained some lead and a larger amount of copper. An investigation of samples from plants in the area showed that they contained 20 times the normal copper content. Thus it can be assumed that the poisoning flue dust is consumed with the fodder. Several other laboratories conducted investigations obtaining much the same results. Some pointed to the lead and arsenic in the organs as possible causes for the poisoning. But further clinic and autopsy reports rule out this possibility. The poisoning in the animals occurred almost exclusively in chronic form. The characteristic symptoms are diarrhea, lack of appetite, loss of weight and no milk production. In many cases the disease starts with running eyes. But most striking are the changes in the skin, it tends to scale off and a rapid loss of hair can be observed. Miscarriages occurred frequently. To make absolutely sure that the poisoning is caused by the copper, liver samples were sent to laboratories. In most cases a multiple of the amount hazardous to health (6 mg in 100g liver) was found. But this is no sure proof either. So far very little is known about copper poisoning due to flue gases in animals. It is also not known in which way copper is poisonous. It may be assumed that the copper dust is converted into a toxic compound on the plant or in the flue gas. The traces of arsenic found in the flue gas may play some role in this chemical process.##

4885 APTIC NUMBER 14018

HEALTH EFFECTS OF AIR POLLUTION. World Health Organization Chronicle (Geneva), 23(6):264-274, June 1969.

The proceedings of a symposium on the health effects of air pollution, sponsored by the World Health Organization and held in Prague on Nov. 6-10, 1967, are summarized. Included among the major sources of pollution in Europe were the incomplete combustion of coal in domestic use and large industrial plants which use oils containing high proportions of sulfur compounds as impurities. Reactions of primary pollutants produce additional pollutants; from the health point of view, the most significant is the oxidation of sulfur dioxide to sulfuric acid. The size of particulate pollutants is probably more important than their chemical nature, since particles small enough to remain suspended in air indefinitely can be inhaled and retained in the lung, as opposed to larger settling particles. Pollution monitoring problems were discussed, and the National Survey of Air

Pollution in the United Kingdom was cited as a model. Recent experimental investigations were described. The uses and drawbacks of morbidity and mortality data and other data sources in epidemiological studies were analyzed; for many purposes, questionnaires were felt to provide the only valid method of making comparative studies. The delayed effect of air pollution in the etiology of bronchitis and lung cancer was discussed; present knowledge seems to indicate that although 3,4-benzopyrene and other polycyclic hydrocarbons are undoubtedly carcinogenic, there is no evidence that, in the amounts normally present in air, they have any detectable effect in causing lung cancer. The effects, if any, are negligible in comparison with those of cigarette smoking. Much current work on the effects of carbon monoxide in the relatively low concentrations in which it usually occurs was summarized, but no definite conclusions are yet available. In a consideration of criteria, guides, and standards of air quality, the pioneer legislation passed in the USSR, and its flexible practical application, was described. Some participants favored the approach of Great Britain, where legislation requires the best practical and available means of control and takes local problems into consideration, rather than applying rigid and specific permissible concentrations of various substances, since such standards should be under constant review.

EFFECTS-PLANTS AND LIVESTOCK

4886

APTIC NUMBER 12530

Bischoff, O.
POISONING OF DOMESTIC ANIMALS THROUGH COPPER AND ARSENIC CONTAINING FLY DUST. ((Vergiftungen durch kupfer-und arsenhaltigen Flugstaub bei Haustieren.)) Text in German. Deut. Tierarztl. Wochschr., 47:442-447, 1939. 8 refs.

A copper smelting plant located in a narrow valley walled in by mountain ridges discharged between 650 and 1250 kg fly dust per day which contained about 2.5% Cu and 23 mg As_2O_3 per kg. Due to this high copper and arsenic output which deposited on plants and grass, numerous cases of poisoning and even death of domestic animals (such as cattle, horses, sheep and poultry) were reported in the vicinity of the plant. An examination of animals which died from poisoning or had to be slaughtered showed an increased copper content in almost all livers (about 30 mg Cu/kg). The clinical symptoms such as miscarriage, sterility, lack of milk etc. lead to the assumption that the arsenic found in the fly ash contributed to the poisoning. It may be assumed that the copper and arsenic experience some chemical reaction in the fly dust which increases the toxicity. The toxic substances were mainly consumed with the fodder. It is unlikely that the plants themselves, by absorbing the poisonous substances from the soil, acted as toxicants since hardly any increased copper content was found by a chemical analysis of some plants and vegetables in the area. The most striking clinical symptoms observed were running eyes, loss of weight and troubles in the digestive and reproductive systems. Autopsies showed an enlargement of the liver and what is quite astonishing, worms were found in the lungs and stomach despite the high copper contents in these organs.##

4887

APTIC NUMBER 12531

Blaser, E.
CONTRIBUTION TO THE KNOWLEDGE OF HYDROGEN SULFIDE POISONING IN ANIMALS THROUGH LIQUID MANURE GAS. (PART II.). ((Ein Beitrag zur Kenntnis der Schwefelwasserstoffvergiftung beim Tier durch Jauchegase.)) Text in German. Schweiz. Arch. Tierheilk., 88:433-446, 1946. 16 refs.

The amounts of H_2S, CO_2 and NH_3 in the air of the stable where the deaths of the two horses from liquid manure gas poisoning occurred was determined, at first under normal conditions in the stable and then under the conditions prevailing on the day of the accident. Standard methods of gas analysis such as titration and gravimetry are discussed and typical values of the composition of air in stables are listed. Mice, rabbit, doves etc. were used for the tests. In the first test these animals showed no abnormal behavior. Two variations of the second test were performed, once with manure drain opening in the stable closed and then open. The stirring mechanism of the manure tank was in operation in both cases. The animals showed no abnormal behavior as long as the opening was closed but did certainly show shortness of breath, apathy and unrest as soon as the opening was uncovered. Some of the animals died very shortly afterwards, the doves and Guinea pigs survived. An autopsy was performed on the dead animals. All animals (also those which survived and were later killed for test purposes) showed typical pathologic-anatomic and above all histologic changes of the organs. H_2S was found in the air only when the outside temperatures were pretty low, but then despite the closed manure drain opening (0.08 to 0.09% at closed opening, 0.4% and 0.24% at uncovered opening.) The NH_3 and CO_2 concentration in the air was found to lie within the values permissible for horse stables. The concrete lid on the manure tank which prevented the escape of the gases, the cold weather and the uncovered manure drain opening as well as the operating stirring mechanism are thus the coinciding factors which led to the accident.##

4888

APTIC NUMBER 14321

Boertitz, Siegfried
PHYSIOLOGICAL AND BIOCHEMICAL CONTRIBUTIONS TO SMOKE DAMAGE RESEARCH. 11. ANALYSES OF SOME NEEDLE CONSTITUENTS OF SPRUCE OF DIFFERENT SO_2 RESISTANCE FROM A DISTRICT WITH SO_2 DAMAGE. (Physiologische und biochemische Beitraege zur Rauchschadenforschung. 11. Analysen einiger Nadelinhaltsstoffe an Fichten unterschiedlicher individueller Rauchhaerte aus einem Schadgebiet). Text in German. Arch. Forstw., 18(2):123-131, 1969. 26 refs.

The first sign of chronic SO_2 influence is aging of the needles in SO_2-sensitive trees. This is accompanied by a decrease in the number of needles and a decrease in the available quantity of reserve substances in the whole tree. In the investigation district (Ore mountains, GDR), even the needles of damaged spruces showed some level of photosynthesis. In comparison with needles of resistant trees, needles of damaged spruces had a lower water content, a higher sugar level, and a higher pH value of their cell sap. Some of these differences were significant over the course of a year. A differentiation into unchanged metabolic processes and processes changed in consequence of continuous SO_2 exposure are not feasible on the basis of these investigations. (Author summary modified)

4889

APTIC NUMBER 13993

Fischer, G. and H. Brantner
STUDIES ON THE SIGNIFICANCE OF AIR POLLUTANTS TO THE GRAZ DISTRICT. II. THE SIGNIFICANCE OF AIR POLLUTION TO AGRICULTURE AND SILVICULTURE. (Studien Ueber die Bedeutung von Luftverunreinigungen fuer den Raum Graz. II. Mitteilung: Die Bedeutung der Luftverunreinigung fuer land- und forstwirtschaftliche Kulturen). Text in German. Arch. Hyg. Bakteriol. (Munich), 152(5-6):393-399, Dec. 1968. 16 refs.

A description of the topographical distribution of species of trees and crops growing in the Graz, Austria, region, as well as of the four types of crop rotation practiced there, is followed by a detailed discussion of the effects of SO_2 on plants. These vary widely, depending on the plant species, the stage of plant growth, the type of soil in which the individual plant grows, the amount of sunlight, humidity, and temperature of ambient air. The SO_2 sensitivity of individual plants varies according to diurnal and seasonal variations of these factors. The SO_2

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tolerance limits for plants are 0.15 to 0.20 ppm, as contrasted with 4 to 5 ppm for man. The authors urgently recommend reducing SO_2 emissions by industry in the Graz region; taking into account the special meteorological conditions of the Graz region in selecting sites for new industrial plants and housing developments; inspection of plant cultures periodically for early detection of SO_2 damage; and choosing crops with higher SO_2 tolerance limits for growth in this area.

4890 APTIC NUMBER 14063

Hibben, C. R.
THE DISTINCTION BETWEEN INJURY TO TREE LEAVES BY OZONE AND MESOPHYLL-FEEDING LEAFHOPPERS. Forest Sci., 15(2):154-158, June 1967. 9 refs.

Both mesophyll-feeding leafhoppers and ozone cause white flecks on the leaves of a variety of herbaceous and woody plants, and the superficial similarities between these symptoms can lead to incorrect diagnosis of leaf damage. When contrasted microscopically and histologically on leaves of sugar maples, flowering dogwood, and northern red oak, the phytotoxic effects of both agents were distinguished by differences in location, configuration, color, and size of external injuries and by characteristics of affected palisade parenchyma cells. Predominate ozone symptoms were adaxial flecks 0.1 to 0.5 mm in diameter, consisting of discolored parenchyma cells in the vein islets. Leafhopper-induced injuries were usually 0.25 to 1 mm in diameter, white, and confined to the adaxial surfaces of leaves. They were characterized by fan-shaped sectors intermixed with green tissue. Dogwood was more resistant to O_3 than maple and oak. The three species displayed similar internal ozone injuries: protoplast and cell wall collapse of palisade parenchyma cells. Leafhopper feeding produced palisade parenchyma cells devoid of recognizable contents. It is not known whether the same mechanical and/or physiological mechanism governs the sensitivity of the palisade parenchyma cells to two such dissimilar irritants.

4891 APTIC NUMBER 12535

Kruger, Gerhard
AN INCIDENT OF DERMOPLAKIA PARALYTICA ALBICANS AFTER TREATMENT OF MANGE WITH GAS. ((Ein Fall von Dermoplkia paralytica albicans im Anschluss an Raudebegasung.)) Text in German. Berlin Muenchn. Tieraerztl. Wochschr., 8:156-157, 1951.

Through the treatment of mange with gas the skin is sometimes injured. This is caused by a reaction of sulphur dioxide with the moist skin ($SO_2 + H_2O = H_2SO_3$). In the spring of 1946 a fifteen year old mare was treated with SO_2 against mange. About eight weeks later an eczema developed which was treated with some sort of cream. The eczema healed within six weeks. Four months after the treatment with gas, spots of white hair of the size of a coin were observed which enlarged rapidly and after 30 months the entire area from the knee upward was affected. About 32 months later the farmer observed some difference in the movement of the right leg as compared to the left, 36 months later frequent stumbling. After another six months the horse fell when it wanted to turn and it could not lie down any more but rested using the wall of its stable as support. In the 46th month the farmer had to slaughter his horse. Two X-rays and an illustration of the spread of the disease are given.##

4892 APTIC NUMBER 14121

Ross, Cleon W., Herman H. Wiebe, Gene W. Miller, and Rex L. Hurst
RESPIRATORY PATHWAY, FLOWER COLOR, AND LEAF AREA OF GLADIOLUS AS FACTORS IN THE RESISTANCE TO FLUORIDE INJURY. Botan. Gaz., 129(1):49-52, 1968. 13 refs.

Leaf disks from 36 varieties of gladiolus were supplied with either 1-C-14-labeled glucose or 6-C-14-labeled glucose. Ratios of C6/C1 were determined and correlated with the fluoride sensitivity ratings reported by Hendrix and Hall. Leaves of varieties which were sensitive to hydrogen fluoride generally had a higher C6/C1 ratio than leaves of varieties resistant to fluoride injury. The results provide circumstantial in vivo support of the hypothesis that the primary fluoride injury mechanism in intact leaves involves the inhibition of enolase. Resistant varieties may be somewhat more dependent on the pentose phosphate pathway and less dependent on the glycolytic pathway than sensitive varieties. (Author abstract modified)

4893 APTIC NUMBER 13985

Shupe, James L.
LEVELS OF TOXICITY TO ANIMALS PROVIDE SOUND BASIS FOR FLUORIDE STANDARDS. Environ. Sci. Technol., 3(8):721-726, Aug. 1969.

Fluorosis, a disease common to cattle, occurs when fluorine compounds are ingested for long periods of time. Hydrogen fluoride and silicon tetrafluoride are two phytotoxic gases encountered in air pollution which may accumulate on the vegetation eaten by livestock. There are no adverse effects on dairy cattle when the fluorine content of the daily ration is less than 30 ppm, while 40 to 60 ppm will result in moderate adverse effects. Acute fluorosis results from ingestion of 250 ppm fluoride and is characterized by stiffness, anorexia, weakness, high blood and urine flouride, convulsions, and cardiac failure. Chronic fluorosis is typified by ingestion of 60 to 100 ppm fluorine/day, by severe dental malformations, and by bone lesions. Fluorine toxicity can be alleviated by administration of aluminum sulfate, aluminum chloride, or calcium carbonate, but the necessity for regulation of fluorine content in air water, food products, and soil is acute. A discussion by L. V. Cralley and John P. Jewell is included.

4894 APTIC NUMBER 14320

Vogl, Michael and Siegfried Boertitz
PHYSIOLOGICAL AND BIOCHEMICAL CONTRIBUTIONS TO SMOKE DAMAGE RESEARCH. 10. INVESTIGATIONS OF DIFFERENT RESISTANCES IN CHRONICALLY DAMAGED PINES IN A SMOKE DAMAGED AREA. (Physiologische und biochemische Beitraege zur Rauchschadenforschung. 10.

Untersuchungen zur idividuellen Rauchhaerte an chronisch geschaedigtenkiefern in einem Rauchschadensgebiet). Text in German. Arch. Forstw., 18(1):61-76,1969. 53 refs.

A field laboratory was established in a smoke-damaged region in order to investigate the physiological reactions of chronically damaged pines. The gas metabolism of severely and slightly injured pines was determined by comparing needle analyses of the two. Gas metabolism (assimilation, transpiration, respiration) and sugar balance in the sap from needles of severely damaged trees were slightly higher than in the only slightly damaged trees. With changing weather conditions and SO_2 emissions, there were no relative depressions of net assimilation in severely damaged trees. Chronic damage of pines is characterized by premature aging of the needles, loss of needle substance, and physiological derangements. (Author summary modified)

4895 APTIC NUMBER 14084

Barrett, R. E.
ALKALI IRON TRISULFATE FORMATION WITHIN DEPOSITS IN AN OIL-FIRED LABORATORY COMBUSTOR. J. Eng. Power, 91(Sect. A, no. 3), July 1969. 14 refs. (Presented at the Winter Annual Meeting of the Am. Soc. Mech. Engrs., New York City, Dec. 1-5, 1968.)

Alkali iron trisulfates ($M_3Fe(SO_4)_3$) are major contributors to the corrosion of superheater tubes of boiler furnaces, and factors affecting their formation were studied in an oil-fired laboratory combustor which simulated a boiler-furnace environment. To produce the high SO_3 concentrations necessary to stabilize trisulfates at superheater temperatures, SO_2 was catalytically oxidized to SO_3 by three fly ashes containing 17 to 30% Fe_2O_3, 38 to 40% SiO_2, and 17 to 28% Al_2O_3. Effects of deposit composition, deposit thickness, temperature, and SO_3 concentration on formation of trisulfates were examined. Preheating of the Fe_2O_3-Kaolin mixtures at 2000 F for 16 hrs significantly reduced the catalytic activity of the mixtures, indicating that the thermal history of fly ash is more significant than its composition in affecting catalysis. Tests show that trisulfates can form within a few hours and in the absence of thick deposits. Potassium appears to be more reactive than sodium in forming trisulfates, while fused deposits, apparently sodium vanadyl vanadate, form readily when both vanadium and alkalies are present. Formation of these molten vanadium compounds is inhibited by magnesium oxide. Although these results are not conclusive in defining the exact corrosion mechanism, they should prove useful in furthor studies of the reactions leading to corrosion and deposits.

4896 APTIC NUMBER 14042

Friehe, Werner, Bernd Meuthen, and Wilhelm Schwenk
WEATHERING BEHAVIOUR OF ALUMINIZED AND GALVANIZED STEEL SHEET IN RELATION TO ALUMINUM AND ZINC SHEET IN INDUSTRIAL, RURAL AND MARINE ATMOSPHERES. (Das Abwitterungsverhalten aluminierter und verzinkter Stahlbleche in Vergleich zu Aluminium- und Zinkblechen in Industrie-, Land- und Meeresluft). Text in German. Stahl Eisen, 88(10):477-484, May 16, 1968. 13 refs.

Steel sheets galvanized and aluminized by the spray and dip methods, steel sheet roll-plated with aluminum, and regular zinc and aluminum sheets were exposed for ten years to industrial air, country air, and sea air. In all test specimens, the thickness of the metal coatings was about 40 micrometers. The specimens were evaluated semiannually and were weighed after various exposure times. Specimens of the zinc series had a constant rate of corrosion depending on the atmospheric conditions. In country and sea air, the efflorescence rate was about 1 micrometer per year; in industrial air it was four times as high. Deviations from constant corrosion rates after five years of exposure were observed on spray-and dip-galvanized specimens and are attributed to the corrosion of the steel base. Because of this phenomenon, it is advisable to provide a coating for the galvanized layer. In contrast to the aluminized specimens, the galvanized specimens are cathodically protected in case of injury to the layer. In country and sea air, the corrosion rate of aluminum coatings is so low that it could not be evaluated. In industrial air the corrosion rate can be described analytically by a parabolic time dependence. From the measured increase in weight, the aluminum consumption during a ten-year exposure can be estimated as about 5 micrometers. Among all metal-coated sheet steels, the dip- and roll-aluminized specimens performed best. However, in industrial air these aluminum coatings do not provide complete protection, since they break down locally and rust pits appear. Nevertheless, damage is not serious.

4897 APTIC NUMBER 14265

Saleh, J. M.
KINETICS OF INTERACTION OF SULFUR DIOXIDE WITH CLEAN AND OXIDIZED METAL FILMS OF IRON, NICKEL AND LEAD. Trans. Faraday Soc., 64(543):796-804, March 1968. 12 refs.

Previous work on the interaction of hydrogen sulfide with nickel, iron, and lead films was extended to examine the effect of sulfur dioxide on the sulfidation of these metals. Rapid and irreversible chemisorption occurred on both iron and nickel films at -80 C; above 100 C, incorporation of the gas took place at a more rapid rate on iron. The incorporation occurred with a constant activation energy which was independent of the thickness of the 'product layer,' and the kinetics obeyed a first order equation. The slow step is probably the dissociative adsorption of an adsorbed SO_2 layer undergoing free translation. Presorbed oxygen on nickel and iron films reduced the total amount of adsorption at -80 C and at the same time greatly lowered the rate of incorporation above 100 C. A multilayer adsorption was observed on lead films at -80 C, a substantial fraction of which was reversible. No clear evidence was obtained for the incorporation of SO_2 in lead films below 300 C. Presorbed oxygen on lead films considerably restricted the mobility of the activated complexes of the reaction. (Author abstract modified)

4898 APTIC NUMBER 14318

Siebel, G.
CORROSION BEHAVIOR OF ALUMINUM SHEETS WITH DIFFERENT SURFACE TREATMENTS AFTER TEN YEARS OF WEATHERING. (Das Korrosionsverhalten von Aluminiumblechen mit verschiedenen Oberflaechenbehandlungen nach 10-jaehriger Bewitterung). Text in German. Aluminium, 45(4):221-225, April 1969. 17 refs.

Aluminum sheets of various degrees of purity and aluminum alloys such as Al-Mg, Al-Mg3, Al-Mn, Al-Mg-Si, and Al-Cu-Mg whose surfaces had been differently treated were exposed to weathering influences in various climates, e.g., Mediterranean, continental industrial, North Sea, warm and humid climate, and changing climate. The samples showed considerable deposits of soot and dust, consisting partially of corrosion products. Particularly large deposits were found on the samples exposed to industrial atmospheres. The deposits on the most important samples, i.e., Al, Al-Mg, Al-Mn, and Al-Cu-Mg, were removed in concentrated HNO_3 at 80 C and the weight loss was determined. For inspection of the surface, the deposits were removed with a chromium phosphoric acid solution at 75 C or with dilute nitric acid.

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The maximum depth of holes was found by selection of the five deepest pittings followed by measurement of depth under the microscope. The copper-free samples showed considerably less deposition; the top surfaces were rather smooth, and the bottom surfaces were pitted, with the exception of the anodized samples. Although the Al-Cu-Mg samples had considerably more deposition than the Cu-free samples, both top and bottom surfaces were rather smooth. The larger deposition is probably due to stronger, more uniform surface corrosion. In this group of Cu-containing alloys, the anodized samples had the lowest deposition, but the quantity was higher than that of the anodized Cu-free samples. The mean maximum depth of the pittings in Cu-free samples was about 0.15 mm. In the Al-Cu-Mg samples, the mean maximum depth was 0.08 mm. In the samples with a 15 micrometer anodized oxide layer, pittings with an average depth of about 0.10 mm were found on the bottom surface.

#899 APTIC NUMBER 14062

Svoboda, M., H. Klicova, and B. Knapek
THE PENETRATION OF SULPHUR DIOXIDE ALKYD RESIN FILMS. J. Oil Color Chemists' Assoc. (London), 52(8):677-686, Aug. 1969. 6 refs.

Alkyd resin film, aged in darkness for 320 days, was rapidly penetrated by sulfur dioxide when immersed in dilute (0.0005 m) aqueous SO2 solutions. Penetration increased to a considerable extent as the concentration of SO2 was increased, approaching an upper limit. The dependence of penetration on temperature was shown by immersing other alkyd resin films, aged 90 days prior to testing, in aqueous solutions at 6, 20, 30, 40, and 50 C. Results showed that the rate of penetration was not zero at 0 C, probably due to the formation of hydrates which exert an appreciable vapor pressure of SO2 at temperatures below 0 C. Experiments at 30 C with solutions containing sodium chloride or sodium sulfate as well as SO2 suggested that the presence of sodium and chloride ions also influenced the penetration rate of SO2. Sulfur dioxide is assumed to penetrate the resin film in the form of free SO2 molecules. It is concluded that the rapidness of SO2 penetration may affect the protective properties of alkyd and other types of paints used to protect metal surfaces against corrosion.

#900 APTIC NUMBER 14139

Todoroki, Eiichi and Satoshi Kado
RELATION BETWEEN STABILITY OF PASSIVE FILM AND ATMOSPHERIC CORROSION RESISTANCE OF STEEL. (Fudotai himaku no antei to taikosei to no kankei). Text in Japanese. Nippon Kinzoku Gakkaishi (J. Japan Inst. Metals), 33(7):815-819, 1969. 8 refs.

The corrosion characteristics of passivated steel in dilute sulfuric acid were investigated because they may correspond to those of steel immersed in concentrated sulfuric acid. The stability of the passive films of low-alloy steel and carbon steel in 5% sulfuric acid was electrochemically studied by the addition of chloride ions. The results were compared with the atmospheric corrosion of these steels. The time variation of the anodic dissolution current after adding chloride ion (200-1900 ppm) was followed for passivated steel in 5% sulfuric acid. It was found that a longer amount of time was needed before a steep rise of current began for steels of higher atmospheric corrosion resistance. These results differentiating the stability of passive films corresponded with those of a five-year atmospheric exposure test in an industrial atmosphere. It was found that the passive film of low-alloy steel is more resistant to the destructive action of the chloride ion than that of carbon steel. This is related to the corrosion characteristics of steel in concentrated sulfuric acid. It seemed that the atmospheric corrosion of low-alloy steel is controlled mainly by the anodic reaction at the thin oxide film formed on the metallic surface. This method is convenient for rapid evaluation of the atmospheric corrosion resistance of low-alloy steels. (Author abstract modified)

#901 APTIC NUMBER 14153

Weintraub, M., S. Goldberg, and A. A. Orning
A STUDY OF SULFUR REACTIONS IN FURNACE DEPOSITS. J. Eng. Power, vol. 83:444-450, Oct. 1961. 5 refs.

The association of external corrosion of certain heat-transfer surfaces in high-pressure, coal-fired boilers with adherent deposits that are rich in alkali metals and sulfur was investigated. The constituents of these deposits are generally combined as normal sulfates, pyrosulfates, or more complex compounds, such as potassium ferric trisulfate. The sulfates found in the deposits do not occur as such in the coal, and therefore were assumed to result from chemical reactions during combustion or from reactions between combustion products and compounds previously deposited on the metal surfaces. A study was made of absorption of sulfur from synthetic flue gas by coal ash. When fly ash was placed in a temperature gradient like that in a boiler tube, deposit, maximum absorption was found in the coldest layer. When held at constant temperature, maximum absorption was found at 1100 F. The amount of absorption was highest for fly ash from furnaces in which serious deposit formation was observed. It was also highest for fly ash containing the highest content of sodium and potassium. A liquid phase of these compounds in contact with tube metal causes corrosion. The maximum sulfur absorption found at 1100 F coincides with a maximum at the same temperature that has been observed for external tube-metal corrosion. (Author abstract modified)

4902 APTIC NUMBER 14140

Neilson, C. A.
REGIONAL AIR QUALITY STANDARDS. Proc. Am. Petrol. Inst.,
Sect. III, vol. 49:592-614, 1969. 9 refs.

It is important that regional air quality standards be very carefully and scientifically established to obtain the optimum and essential results without excessive cost and economic disruption. The Congressional Air Quality Act of 1967 provided a well-organized program for air quality improvement. This included the designation by the Department of Health, Education and Welfare of atmospheric areas and air quality control regions, and the development of air quality criteria with summations of control technology and comprehensive cost studies. These are to be followed by the states with regional ambient air standards and enforcement plans, established by the state planning agencies with the aid of public hearings, and all with the final approval of HEW. Because the published information on the effects of very low levels of pollutants on health is extremely limited, and synergistic effects in most instances are unknown, much more research and accurate information is needed to establish ambient air standards. For this reason, active participation by industry in the setting of standards and in the development of enforcement plans is essential, especially in making known the economics and limitations of present control technology. The American Petroleum Institute Committee for Air and Water Conservation is active in sponsoring research in many fields relating to air quality. It has sponsored symposia on this subject and has commissioned many eminent consultants to prepare critical surveys. (Author abstract modified)

LEGAL AND ADMINISTRATIVE

4903 APTIC NUMBER 14273

Air Pollution Control Board, Bedford Park, Ill.
AIR POLLUTION CONTROL BOARD ANNUAL REPORT 1968 TO THE PRESIDENT & BOARD OF TRUSTEES. 25p., 1969.

The goals and accomplishments of the Village of Bedford Park Air Pollution Control Board are summarized in this third annual report. Enforcement activities included issuance of citations for infractions of the air pollution ordinance and approval of open fire permits; 23 meetings of the Board were held during 1968 to pass on all relevant matters. The services of a chemical engineer were engaged as a technical assistant for the program, and an effective educational and information program was maintained. Through the villages permit system, the consumption of fuel oil and coal and the industrial emission of particulates have been effectively reduced. Equipment requirements for pollution monitoring are reviewed. Information on the pollution control program was supplied to other municipalities as requested by them. Technical information presented in the report includes a tabulation of complaints and investigations; permits granted for open fires, fuel burning, and combustion or process equipment; results of industrial emissions and ambient air quality measurements; and budget information.

4904 APTIC NUMBER 14144

Amero, R. C. and R. P. Foster
IMPACT OF THE FAST-GROWING GAS TURBINE MARKET ON REFINERY FUTURES. Proc. Am. Petrol. Inst., Sect. III, vol. 49:281-308, 1969. 26 refs.

The purpose of the study is to alert the petroleum refiner to the importance of including flexibility into future process design so that not only gasoline but also the expanding turbine fuel requirements can be satisfied. Gas turbines are the dominant power plant in the expanding aircraft industry and are also well accepted as prime movers for electrical generators, pumps, and compressors. The experimental stage of marine application is ending and commercial acceptance is starting. Increased use of gas turbines for mobile equipment will follow, starting first with large equipment such as commuter trains, mining and logging equipment, and trucks. A 1980 market for 500,000 barrels per day of distillate fuel for nonaircraft gas turbines is likely. This number was predicted primarily from utility peaking plants and marine use, but includes total energy, transportation, pumping, and other industrial uses. Installations using several hundred barrels per day will not be unusual, where the turbines will be tailored to some degree to burn heavier or more aromatic distillates or other fuels that offer a price advantage. In the U. S., the large turbines using natural gas, blast furnace gas, and other fuels will outnumber those using distillate fuel. In sizes below 1000 hp, the 1980 gas turbine count will still be less than 2% of the diesel and gas engine population. Fortunately, the engines and turbines both prefer clean-burning fuels of low aromatic content, and this is also the direction that distillate fuel quality will take because of air pollution controls.

4905 APTIC NUMBER 14195

Butrico, Frank A.
EARLY WARNING SYSTEMS CONCERNED WITH ENVIRONMENTAL CONTAMINANTS. J. Public Health, 59(3):442-447, March 1969.

The need to have centers that will rapidly analyze the effects of environmental contaminants is emphasized. An early warning system is proposed with suggested major categories of information and critical indicators. Some major categories of information are: production figures, secondary product information, pattern of usage, toxicology and pharmacology, and environmental health hazards. Those agencies which provide this information are listed. A panel on scientific and technical communications has stated that experimental or exploratory systems capable of handling actual problems which will evolve into operational systems should be formulated. Any information surveillance system that is developed must have input from the nation's top specialists and experts. Much of this expertise is now being utilized by government agencies and Congress to identify the nature and magnitude of environmental problems and to indicate possible directions for government action. A biological early warning system attuned to the interaction of contaminants on biological systems is also needed.

4906 APTIC NUMBER 14250

Corrigan, T. E., W. E. Lewis, and K. M. McKelvey
WHAT DO CHEMICAL REACTORS COST IN TERMS OF VOLUME/ Chem. Eng., 74(11):214-215, May 22, 1967.

Installation costs for 1967 are shown on a volume basis for a variety of chemical reactors: batch, semi-batch, tubular, continuous stirred tank, towers, catalytic fixed-bed, and catalytic fluidized-bed. All costs are adjusted to a Chem. Eng. Plant Cost Index of 100, a common base that is easy to use when further updating is required.

4907 APTIC NUMBER 14270

Hart, S. J.
PROBLEMS OF GASEOUS EFFLUENTS. Preprint, Combustion Engineering Assoc., Hayes, Middx., Great Britain, 20p., May 2, 1969. (Presented at a Meeting of the Combustion Engineering Assoc., Manchester, March 25, 1969, Document 8603.)

A brief history of clean air and emissions control legislation in England is given, starting with the Alkali Works Regulation Act of 1863, which limited concentrations of hydrochloric acid in the exit gases of alkali processing, and culminating in the Clean Air Act of 1968. In this legislation, most plants are required to employ the 'best, practicable means' for emissions control; in addition, the Alkali Inspector sets presumptive limits as guidelines for enforcement. Since it is recognized that in practice, 100% control of pollutant emission cannot be achieved, adequate stack heights, calculated on the basis of a

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formula which takes into account wind speed, emission rate, and other relevant factors, are a complementary means of compliance. A general survey is presented of the technology of cleaning gas effluents by scrubbers and other methods, using fabric filters for metallurgical fumes and electrostatic precipitators for cement dust. In 1958, regulations were passed to cover very heavy smoke producers, including lime burning and certain ceramic industries, and particulate emissions - classified as grit, dust, and fumes - from such industrial sources as electricity production and metallurgical processing. The technical problems of emissions control in each of these industries are discussed in some detail. A record is included of the discussion of this paper by participants at the meeting at which it was presented.

4908 APTIC NUMBER 14172

Kiyoura, Raisaku and Milton Munidasa
THE SULPHUR SITUATION IN JAPAN. Bull. Tokyo Inst. Technol., no. 98:13-19, 1969.

Japan, traditionally an importer of sulfur, has been a sulfur exporter since 1967. This was due in large part to the world's first residual oil desulfurization plant, built by the Idemitsu Oil Refining Co. at Chiba, which went into operation in November 1967. The cost of the plant was about $20 million; its projected total annual sulfur production is expected to be about 54,000 tons. Other such plants are being built under the pressures of increasingly stringent air pollution control requirements and a world sulfur situation exhibiting tight supplies and rising prices. Japan's recent sulfur surplus is expected to reduce domestic prices unless continuing heavy international demand counteracts this. If the surplus prevails and prices remain low, then a change in the raw material used to produce sulfuric acid may occur, from the traditional pyrites, of which Japan is the world's largest producer, to elemental sulfur. Data are presented on the demand and supply of these raw materials in Japan, as well as on desulfurization plants existing or under construction, sulfur recovery from oil refineries, and sulfur consumption. It is believed that in the present state of development, any sulfur recovered from processes for flue gas desulfurization would not significantly alter the economic situation of sulfur production.

4909 APTIC NUMBER 14275

Public Health Service, Durham, N. C., National Air Pollution Control Administration
REPORT FOR CONSULTATION ON THE STEUBENVILLE-WEIRTON-WHEELING AIR QUALITY CONTROL REGION (OHIO, WEST VIRGINIA). 46p., Aug. 1969.

In accordance with the Air Quality Act of 1967, boundaries are proposed for an air quality control region as a background to the consultations with State and local officials required for establishing such a region. The boundaries attempt to meet three basic objectives: that a region should be self-contained with respect to pollution sources and receptors: that the region should be designated in such a way as to apply to future as well as to present conditions; and that the boundaries should foster cooperation between the various governmental bodies administering pollution control throughout the region. The proposed region encompasses the following jurisdictions: Belmont and Jefferson Counties in Ohio, and Brooke, Hancock, Marshall, and Ohio Counties in West Virginia. Columbiana County in Ohio is also suggested for possible inclusion, depending on the results of consultation with local authorities, or, alternatively, for frequent review should regional boundaries be expanded in the future. Details are presented of the urban and engineering evaluations on which the delineation of the proposed boundaries were based; these include present and future population and industrial factors, existing air pollution control programs, regional planning in the upper Ohio River area, a pollutant emissions inventory, topographical and meteorological considerations, and an air quality analysis.

4910 APTIC NUMBER 14277

Public Health Service, Durham, N. C., National Air Pollution Control Administration
REPORT FOR CONSULTATION ON THE PUGET SOUND AIR QUALITY CONTROL REGION (WASHINGTON). 57p., July 1969. 21 refs.

In accordance with the Air Quality Act of 1967, boundaries are proposed for an air quality control region as a background to the consultations with State and local officials required for establishing such a region. The boundaries attempt to meet three basic objectives: that a region should be self-contained with respect to pollution sources and receptors; that the region should be designated in such a way as to apply to future as well as to present conditions; and that the boundaries should foster cooperation between the various governmental bodies administering pollution control throughout the region. The proposed air quality control region encompasses King, Pierce, and Snohomish Counties in the Puget Sound area of Washington. Details are presented of the urban and engineering evaluations on which the delineation of these boundaries were based, including present and future population and industrial factors, existing air pollution control programs, regional planning in the puget sound area, a pollutant emissions inventory, topographical and meteorological considerations, and an air quality analysis. These evaluations have shown that the most dense concentration of pollution sources and receptors are located along the corridor of land containing the cities of Everett, Seattle, and Tacoma; this corridor also contains about 80% of the total population of the counties adjacent to Puget Sound. Thus, the three counties which contain this corridor constitute the basic core of the regional air pollution problem. Kitsap County is suggested for possible inclusion in the region, depending on the outcome of scheduled consultations with State and local authorities; if not included, it is suggested that it comes under frequent review in case of future expansion of the regional boundaries.

4911 APTIC NUMBER 14256

TRW Inc., Redondo Beach, Calif., TRW Systems Group
REGIONAL AIR POLLUTION ANALYSIS. PHASE I. Contract PH 22-68-60, Status Report, 449p., July 1969. 30 refs.

The Regional Air Pollution Analysis (RAPA) program is a modular integration of mathematical models based on presently available scientific data and can easily incorporate improvements. The system was guided by the intentions of the Air Quality Act of 1967, sulfur oxides and particulate criteria documents, existing computer programs and mathematical models, and guidelines set forth by the National Air Pollution Control Administration. The program is versatile and processes a myriad of air pollution data. The processing of this information permits RAPA's users to determine which control approach might best achieve the regional goals in air quality standards. The program was demonstrated using St. Louis data and a set of air pollution abatement strategies. The RAPA process began with the user specifying a desired air quality goal for the region. The air quality standard is accepted along with the region's existing emission inventory and meteorological conditions, and the computer calculates the diffusion of pollutants throughout the region. The result is a determination of the existing air quality and a list of those receptors, area sources, and pollutant contributors which exceed the standard. The user then selects an abatement strategy for controlling or preventing pollutant emissions and provides the computer program with strategy identification. The RAPA program calculates the control cost and control efficiency of each measure applicable to each pollutant source in the region. The computer calculates the emission reduction required at each source and selects the least expensive control device. The user computes the estimated effect on the regional economy of investments and operating expenses for the control measures. All the calculations result in an estimated regional impact which is analyzed by the user to determine whether air quality standards and goals are met. A shortcoming to this method is the degree of credibility attributable to the results, since they come from a machine. Use of the RAPA program must be tempered with a thorough knowledge of the program's information requirements.

4912 APTIC NUMBER 14292

AIR POLLUTION BY AUTOMOTIVE EXHAUST GASES. (Luftverunreinigung durch Autoabgase). Text in German. Umschau (Berlin), 69(12): 378-380, June 1969. 14 refs.

The threshold limit value for eight hours has been set at 50 ppm for carbon monoxide, 5 ppm for nitrogen oxides, and is still highly debated for hydrocarbons. Suggestions for limitations range from 50 to 500 ppm. Soot is not toxic but it is a carrier of the carcinogen benzopyrene. A study of the effect of atmospheric lead conducted in the U. S. showed that the level of lead in the population did not change for 30 years, although consumption of lead-containing gasoline rose 2.5 times since 1944. Legislation first initiated in California has become exemplary for the whole world. Attempts to regulate emission by motor vehicles are underway everywhere. In West Germany, the opinion has been voiced that total automotive emissions ought to be reduced. Contrary to California, Europe generally considers limitation of carbon monoxide more important than reduction of hydrocarbon emission. In order to initiate adequate measures, continuous air quality measurements are necessary. These have been conducted in Paris for several years at 317 points across the city. Similar measurements have also been taken in several West German cities. The measurements showed that carbon monoxide emissions were, on the average, below the maximum allowable concentrations. They could still be further reduced by a more rapid traffic low through these cities. Engine operation modification is recommended.

4913 APTIC NUMBER 13980

Nishiyama, Keitaro, Mitsuyoshi Nagayasu, Takeo Azuma, and
Masaichi Ishizawa
STUDIES OF THE PREVENTION OF PUBLIC NUISANCE BY THE EXHAUST GASES FROM THE KRAFT PULP MILL. PART 3. INFLUENCES OF ODOR ON N-AREA INHABITANTS. (KP seishi kojo haigasu no kogai boshi ni kansuru kenkyu dai 3 ho kojo shuhen no shuki ni taisuru jumin no hanno ni tsuite). Text in Japanese. Shikoku Igaku Zasshi, (Shikoku Acta Medica), vol. 24:43-52, 1968.

A survey of bad odor was undertaken in the area within 6 km of a kraft pulp mill labeled the N mill. Of 749 inhabitants, 87.8% recognized the bad odor and most referred to the mill as its source. A number of people found that the odor existed throughout the year. This is due to the unstableness of the wind direction in the area. Approximately 29% of the inhabitants were forced to close the windows and doors and 52% of that group said they failed to get rid of the odor. The chief complaints of the inhabitants were unpleasantness, mental oppression, meals not enjoyed, disturbed reading and work, and respiratory disorders. Comparative studies of locations in different directions and distances from the mill did not show clear differences.
(Author abstract modified)

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GENERAL AND MISCELLANEOUS

4914 APTIC NUMBER 14002

Levitsky, Serge L.
SULPHUR. Mining Congr. J., 52(2):170-174, Feb. 1966.

Only a few years ago, sulfur producers were in the midst of a protracted period of oversupply. Today, as a result of the increased use of fertilizer to stimulate food production, producers are faced with a situation of short supply and rapidly decreasing inventories. The circumstances which led to oversupply are not likely to be duplicated. Even when sulfur from high-cost sources, such as pyrites, sulfur dioxide in smelter gas, native ore, anhydrate, and gypsum, become more economical to mine and produce, producers must still finance the development and expansion of sources of lower-cost sulfur. Current low-cost sources are represented by the Frasch sulfur mines and the recovery of sulfur from the H_2S in natural sour gas and petroleum refinery gases. Countries outside the Communist bloc consumed 840,000 tons more Frasch and 550,000 tons more 'recovered' sulfur in 1965 than in 1964, but the production increases in these two segments of the industry amounted to only 780,000 and 470,000 tons, respectively. Unless the growing discrepancy between world market prices and domestic prices is narrowed, American producers will be deprived of the financial incentives necessary to expand their productive capacities and reserves commensurate with future sulfur needs.

4915 APTIC NUMBER 13954

Morrison, Warren E.
THE ENERGY DILEMMA - WHICH FUEL, WHAT MARKET, WHEN/ Preprint No. 65K302, Society of Mining Engineers, AIME, N. Y., 26p., 1965. (Presented at Rocky Mountain Minerals Conference, Fall Meeting of the Society of Mining Engineers, Phoenix, Ariz., Oct. 7-9, 1965.)

The future energy economy is forecast over 5-year intervals, spanning 15 years, in terms of the future demand for specific resources and the levels of domestic supply and foreign trade required to meet this demand. The forecast includes a short-term forecast to 1965, two intermediate forecasts to 1970 and 1975, and a terminal forecast to 1980. The basis of the forecast is the historical balance of gross consumption of energy by consuming sectors during the period 1947-1963. Through the application of econometric procedures and forecasting techniques, the components of the historical balance are projected forward and composite energy balances are drawn up for each of the forecast periods. Separate projections are made for each major energy resources--coal, natural gas, petroleum, hydropower, and nuclear power; for the four major energy markets--household and commercial, industrial, transportation, and utility power; and for the basic form that resources assume within these markets--electricity, direct fuels, and raw materials. While total energy is projected to increase at a rate of 3.2, petroleum and natural gas will grow at somewhat slower rates than in the historical period. Nevertheless, the two resources are expected to account for 73% of total energy consumption in 1980. Bituminous coal, due to its demand for utility electricity, will grow at a rate of 2.4% but will provide a smaller portion of total energy by 1980. Conventional energy sources will feel the impact of commercial nuclear power, which will constitute 5% of total energy by 1980. Hydropower will grow at about the same rate as during the historical period.

4916 APTIC NUMBER 14005

Moureu, Henri
THE AIR POLLUTION PROBLEM. (Le probleme de la pollution atmospherique). Text in French. Chim. Ind. (Paris), 99(11): 1723-1727, June 1968.

Air pollution occurs when the air people breathe at the rate of 15 kg per day is modified by strong concentrations of one or more of its natural components. In urban areas, 20 to 25% of the total air pollution is caused by industrial furnaces, 50 to 60% by domestic furnaces, and 20 to 25% by automobile emissions. In Paris, the detection, analysis, and measurement of carbon oxides and automobile exhausts is supervised by the Municipal Laboratory of the Police Department, while the study of sulfur dioxide is directed by the Hygiene Laboratory of the City of Paris. Large-scale pollution studies are also being carried out in regional laboratories. Pollution from residential sources can be reduced by the use of fuel with a low sulfur content, or by gas and electric power. Costs of industrial anti-pollution equipment ranged from five to 24 million francs in 1960. A simple method for reducing the rate of carbon oxides emitted by automobile exhaust gas has been developed by the Police Department of Paris.

4917 APTIC NUMBER 13973

Munn, David
INSULATED STEEL CHIMNEYS. THEIR DEVELOPMENT FOR INDUSTRIAL USE. Works Eng. Factor Serv., 63(749):60-61, Nov. 1968.

The steel chimney of any boiler plant is vulnerable to corrosion, which in turn leads to smut emission. In an ordinary single-skin steel chimney, the high thermal conductivity of the metal results in a relatively low wall temperature which can fall below the acid dew point, usually about 270 F, and thus promote corrosion. The corrosive effect rises to a maximum as the surface temperature reaches a level of about 50 F below the dew point. Sulfurous acid is also formed in the process when sulfur dioxide combines with water at temperatures below about 140 F, the water dew point. Increased efficiency in boiler plants and increasing chimney heights as a result of clean air legislation have acted to aggravate the corrosion problem. As a countermeasure, chimney insulation methods were developed. At present, there are numerous insulated chimneys on the market consisting of two concentric steel shells with an insulation of varying materials and thickness between them, called 'Dribore' double-skin chimneys. The design features of such chimneys are described. Brick chimneys, designed for solid fuel boilers and since converted to oil firing, can be modified to reduce corrosion by attaching an insulated steel liner within the bore of the brick stack.

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